VU-DATA CORPORATION

A LEADER IN PORTABLE OSCILLOSCOPES

U-DATA
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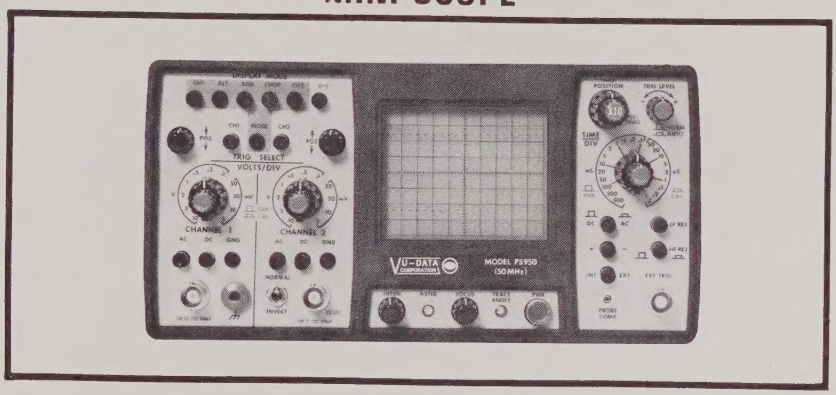
TECHNICAL MANUAL

NOV. 1, 1979

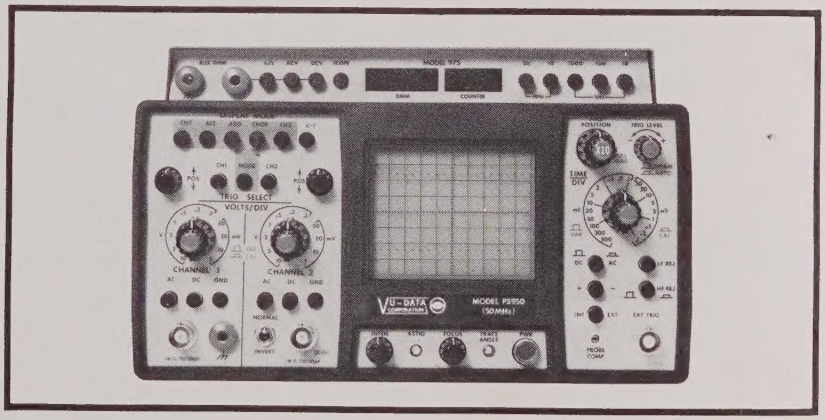
MODEL PS950

MINI-SCOPE



MODEL PS950/975

DMM-COUNTER-MINI-SCOPE



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PS950/975

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SECTION I

GENERAL DESCRIPTION

Figure 1-1. Model PS950/975 DMM-Counter-Mini-scope

SECTION I

1-1. INTRODUCTION

1-2. This manual contains complete operation, calibration and maintenance instructions for the Model PS950/975 DMM-Counter-Mini-scope. It should be employed for the Model PS950/975 Mini-scope alone, or in combination with the Model 975 DMM-Counter. See Figure 1-1.

1-3. The purpose of this manual is to provide the operation, calibration and maintenance information required by the equipment operator or service technician. The manual does not include information pertaining to special equipment applications, nor does it include instructions for accomplishing repairs of the type performed at the factory.

1-4. The manual is divided into seven sections. Section I provides general information regarding the purpose of the equipment, its physical arrangement, and its pertinent specifications. Section II contains information on installation and unpacking. Section III contains instructions for the equipment, circuits and mechanisms. Section V provides test, alignment, and maintenance procedures. Section VI contains a complete parts list. Section VII contains complete circuit drawings.

WARNING

When performing the power supply alignment, the instrument may be operating with the covers removed. High voltages, which could be lethal, are accessible and extreme caution should be taken. Only screwdrivers with insulated shafts should be used for setting the adjustments. The covers should be removed only for the duration of time to make the alignments. The power should be off while the covers are being removed or installed.

1-5. INSTRUMENT DEFINITION

1-6. The Model PS950 is classified as a "mini-scope", in that it is less than 15 pounds in weight, is small enough to fit into a tool kit or briefcase, and offers battery power capability. As such, it serves as a useful high frequency visual trouble-shooting tool for field service and laboratory test applications. In conjunction with the Model 975 DMM-Counter, the versatility of this test instrument is greatly inhanced.

1-7. In summary, the Model PS950/975 DMM-Counter-Mini-scope is the world's first 50 MHz oscilloscope that includes a digital multimeter (DMM), a frequency counter and a dual-trace oscilloscope packaged together in a single unit with all three measuring devices possessing their own dedicated displays. All three "sub-instruments" can be employed simultaniously as complements to each other, or they may be used independently at the same time.

1-8. The Model PS950 Mini-scope is a 50 MHz bandwidth, triggered sweep, dual-trace oscilloscope. Vertical sensitivity is 5 mV/DIV, and fastest sweep rate is 100 nsec/DIV which can be increased to 10 nsec/DIV by a X10 magnifier. External trigger as well as external X-axis input capability are also included. The CRT viewing area is 8 X 10 major divisions with each division equal to 1/4 inch. Model PS950 may be ordered separately, or in combination with the Model 975 DMM-Counter. Model 975 includes a 3 1/2 digit, auto-ranging digital multimeter (AC volts, DC volts, and Ohms), as well as a 4 digit, 50 MHz frequency counter. The unit can be operated from normal AC line power or, with Option PS9310 Battery Pack/AC-DC Power Supply installed, from a battery power pack. Removal of the "Battery Pack" portion of Option PS9310 enables the unit to be operated from an external 12 VDC source. Basic dimensions for the Model PS950 are 4.2"H x 8.5"W x 15.4"D. With the 975 added, total package height is increased to 5.2". The battery pack adds an additional 1.0" of height. Weight of the PS950 is 14 pounds; the 975 adds 1 pound and the PS9310 adds 6 pounds.

1-9. Aside from the front panel controls for the features mentioned above, the right rear side panel includes the following controls: AC power line fuse holder with combination power connector and AC line voltage selector mechanism (100 V, 120 V, 220 V or 240 V), and a switch for power on/off or battery charging. It should be noted here that the Option PS9310 Battery Pack/AC-DC Power Supply, when ordered, is substituted in place of the standard PS950 AC power supply; it must be ordered in conjunction with the PS950 or the PS950/975. The battery pack is mounted to the bottom panel; in its absense, jacks are available on the bottom panel for external DC power. The Model 975 DMM-Counter mounts to the top of the unit and is powered from the Model PS950 Mini-scope. See Figures 1-2, 1-3, and 1-5.

1-10. Standard accessories which accompany each unit at time of shipment include an operator's manual, detachable AC power line cord, front panel protective hood and DMM test leads (when Model 975 DMM-Counter is included). See paragraph 1-27 for a complete listing of optional accessories.

1-11. APPLICATION

1-12. The reality of today's needs in a mobile test equipment environment has been faced up to, and Vu-data has acknowledged this by recognizing the need for coordinated measurements. This has been accomplished in the Model PS950/975 by supplying a DMM, counter and dual-trace scope in a single package in which all three instruments can be used to complement each other simultaneously using a single input, or each can be employed independently from the other two.

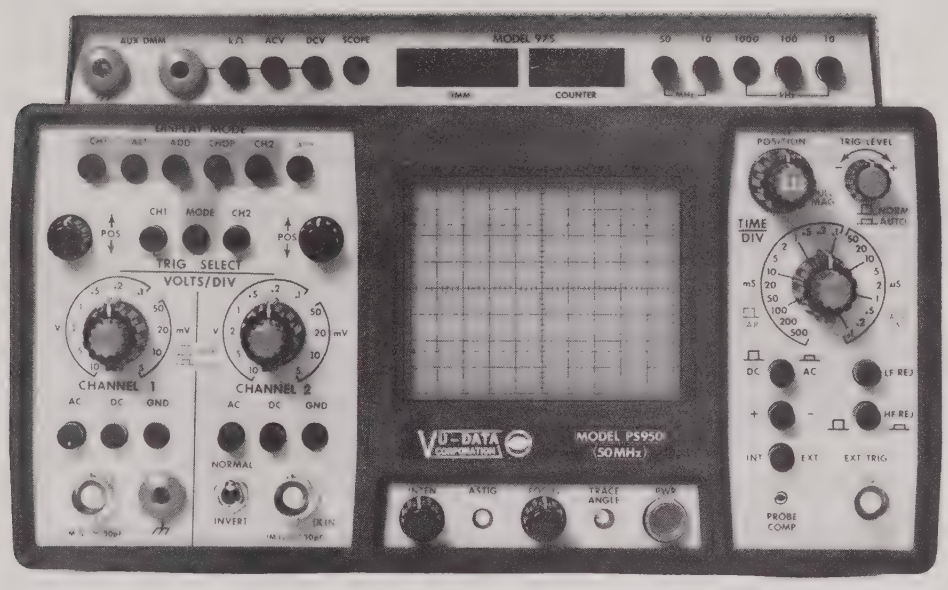

Figure 1-2. Front Panel Controls for Model PS950/975

Figure 1-3. Rear Panel Control for Model PS950

Furthermore, the Model 975 DMM-Counter provides the ultimate solution to an age-old oscilloscope nuisance. In the past, the RMS value of a sine wave presentation on a scope was determined by a tedious mental calculation. First, the vertical deflection on the CRT was carefully measured in major and minor graticule divisions, after making sure the vertical attenuator vernier was in "CAL". The attenuator setting was observed next and multiplied by the number of divisions previously measured. This product, peak-to-peak amplitude, was then divided by $2\sqrt{2}$ (or 2.828) to arrive at the RMS equivalent. Now, with the Model 975 DMM AC converter (calibrated in terms of RMS), the RMS value of a sine wave displayed on Channel 1 can be automatically measured and displayed directly in the form of a digital readout.

In a similar fashion, the frequency of the signals displayed on Channel 1 or Channel 2 can be read out directly by the Model 975 Counter instead of the operator having to calculate its frequency by observing how many cycles occur per division and dividing this number by the calibrated sweep rate control setting. Channel 1 or Channel 2 trigger selection determines which signal is measured by the counter.

And finally, the convenience of the Model 975 with its combination DMM and counter is further emphasized by the fact that the DMM and counter serve as built-in scope attenuator and sweep rate calibration verification tools, respectively.

1-13. The Model PS950/975 DMM-Counter-Mini-scope includes three separate measurement displays: a 3 1/2 digit display for the DMM, a 4 digit display for the frequency counter and an 8 x 10 div CRT display for the oscilloscope. Calculator size LED'S are employed as the digital displays. They afford the smallest possible total package, while at the same time providing adequate viewability, considering a scope operator is generally observing the CRT display at close range to determine divisions of deflection of the waveform on the CRT.

1-14. Key operational features for each of the DMM, counter and scope are described below:

MINI-SCOPE: The basic features of the Model PS950 Mini-scope are described in paragraph 1-8, and basic specifications are included in paragraph 1-22. The important point is that the scope includes the circuitry to provide information to the Model 975 DMM-Counter for digital display of the AC or DC voltage (Channel 1), and frequency (Channel 1 and 2), of the displayed waveforms.

In the case of voltage, the DMM is programmed to measure AC volts or DC volts by the Channel 1 AC/DC input coupling selector push buttons, assuming the "SCOPE" push button on the DMM has been depressed. The scope input impedance is 1 Mohm, so either a X1 or X10 probe may be employed.

Relative to frequency, the scope provides the counter with trigger pulses from its horizontal circuit trigger generator. These enable the counter to display the frequency of any signal that is synchronized on the CRT in the "internal trigger" mode. The Channel 1 or Channel 2 frequency displayed

is determined by Channel 1 or Channel 2 trigger selection, respectively. In the "external trigger" mode, the scope trigger generator pulses represent the frequency of the external trigger signal, and the counter displays that frequency.

DMM: The auto-ranging DMM will measure and display average AC volts (calibrated in terms of RMS), DC volts or Kohms through its auxiliary input connector; it will then indicate the RMS value of a Channel 1 sine wave displayed on the CRT, or it can indicate the DC component of the displayed AC signal, or it can indicate the value of a DC level displayed on the CRT. In the "SCOPE" mode, the DMM is programmed for AC or DC by the scope input coupling selector.

COUNTER: As previously discussed, the frequency counter is activated by the scope trigger generator pulses. In the "internal trigger" scope mode, the counter displays the frequency of the synchronized displayed waveform. It is virtually immune from the input sensitivity problems normally assoiated with other frequency counters because the scope trigger generator pulses are always of a constant amplitude.

In the "external trigger" mode, the counter displays the frequency of the signal connected to the external trigger input BNC, whether a synchronized waveform is displayed on the CRT or not. In this application, the scope trigger level must be adjusted properly, but this can be verified by the presence of a synchronized CRT display, or a bright baseline in the absence of a synchronized signal.

Period measurement capability is not included in the counter since the CRT display with its calibrated time base provides a ready measurement of the period of a signal.

1-15. PHYSICAL DESCRIPTION

1-16. The Model PS950/975 DMM-Counter-Mini-scope is comprised of two self-contained instruments, Model PS950 Mini-scope and Model 975 DMM-Counter. The Model 975 DMM-Counter can be ordered only in conjunction with the Model PS950 Mini-scope; the Model PS950 Mini-scope can be ordered separately. Model PS950 is comprised of : (1) a CRT display module which includes the CRT and the high voltage power supply and vertical output circuitry, (2) a vertical plug-in module, (3) a horizontal plug-in module and (4) the power supply module. The Model 975 DMM-Counter is included on a single printed circuit board which is plug-in compatable with the Model PS950 Mini-scope. The Model 975 DMM-Counter derives its power supply voltages, programming logic and scope signal inputs from the Model PS950 Mini-scope. See Figure 1-4.

1-17. All major circuitry consists of standard off-the-shelf discrete components and integrated circuits of U.S. manufacture. Silicon semiconductors, tantalum capacitors and MOS integrated circuits are employed to increase reliability. All principal components, voltage levels and test points are identified by reference designators and symbols; all diodes and tantalum capacitors are identified for polarity.

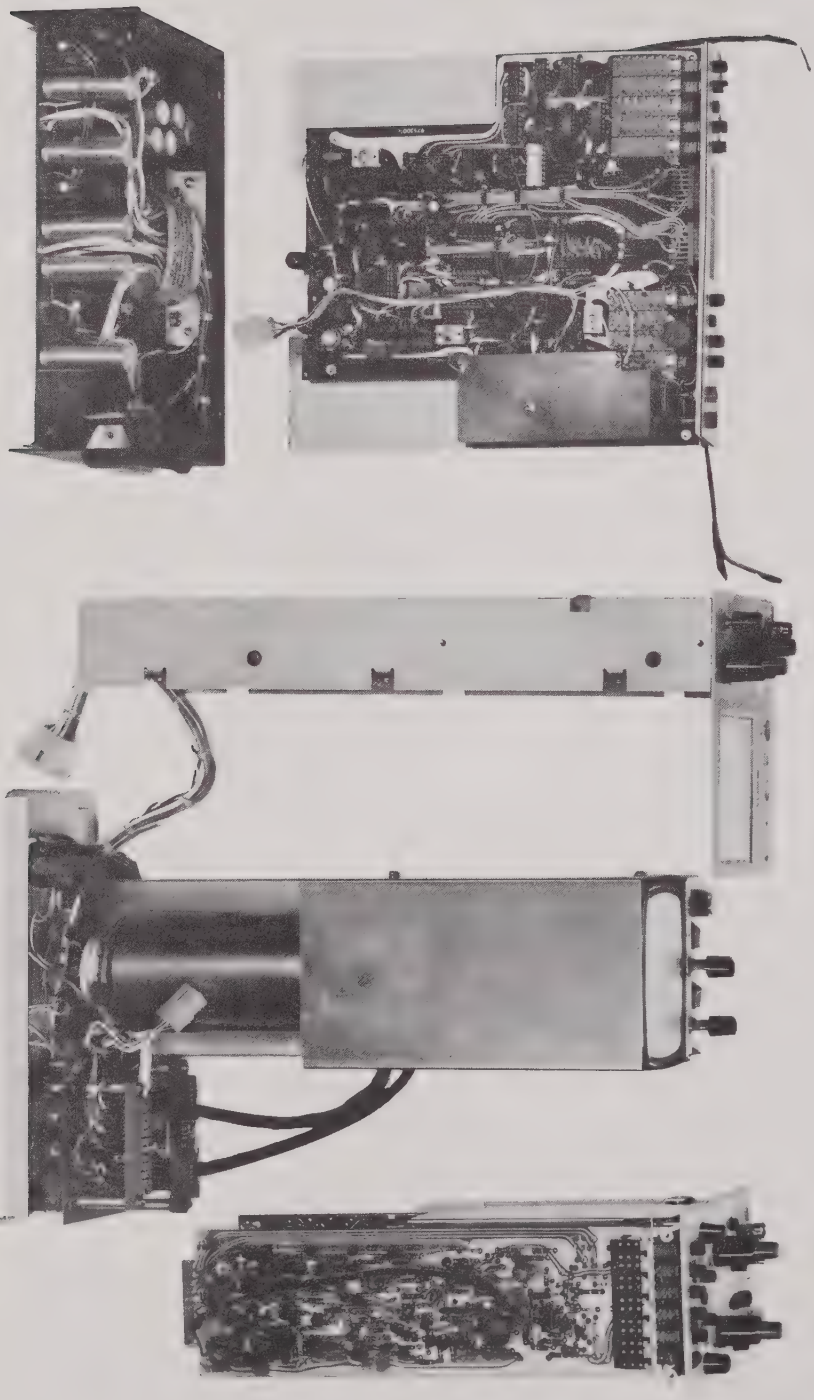

Figure 1-4. Model PS950/975 Modular Plug-In Assemblies

1-18. Front and rear controls are provided for ease of operation. Refer to Figures 1-2 and 1-3, respectively, and to Section III of this manual for a detailed explanation.

1-19. A fully shielded 5 cm x 6 cm flat faced, rectangular CRT is provided and secured rigidly within the display module. The graticule is internal, black lined and non-illuminated. It includes an 8 x 10 major division area. Each 1/4 inch major division is divided into 5 minor divisions. Graticule area is 2.0" (vertical) x 2.5" (horizontal).

1-20. The Option PS9310 Battery Pack/AC-DC Power Supply must be ordered in conjunction with the Model PS950 or the Model PS950/975. As previously discussed in paragraphs 1-8 and 1-9, the "Battery Pack" mounts to the bottom panel of the PS950, and the "AC-DC Power Supply" is substituted in place of the standard AC Power Supply of the PS950. Battery recharging circuitry is contained within the "AC-DC Power Supply", and electrical interface between this power supply and the "Battery Pack" is accomplished through the external DC source input connectors on the bottom panel. These connectors become available for external 12 VDC source input by removal of the "Battery Pack". See Figure 1-5.

1-21. All units may be rack mounted by installing the optional Rack mount kit. Refer to paragraph 1-27 and Figure 1-6.

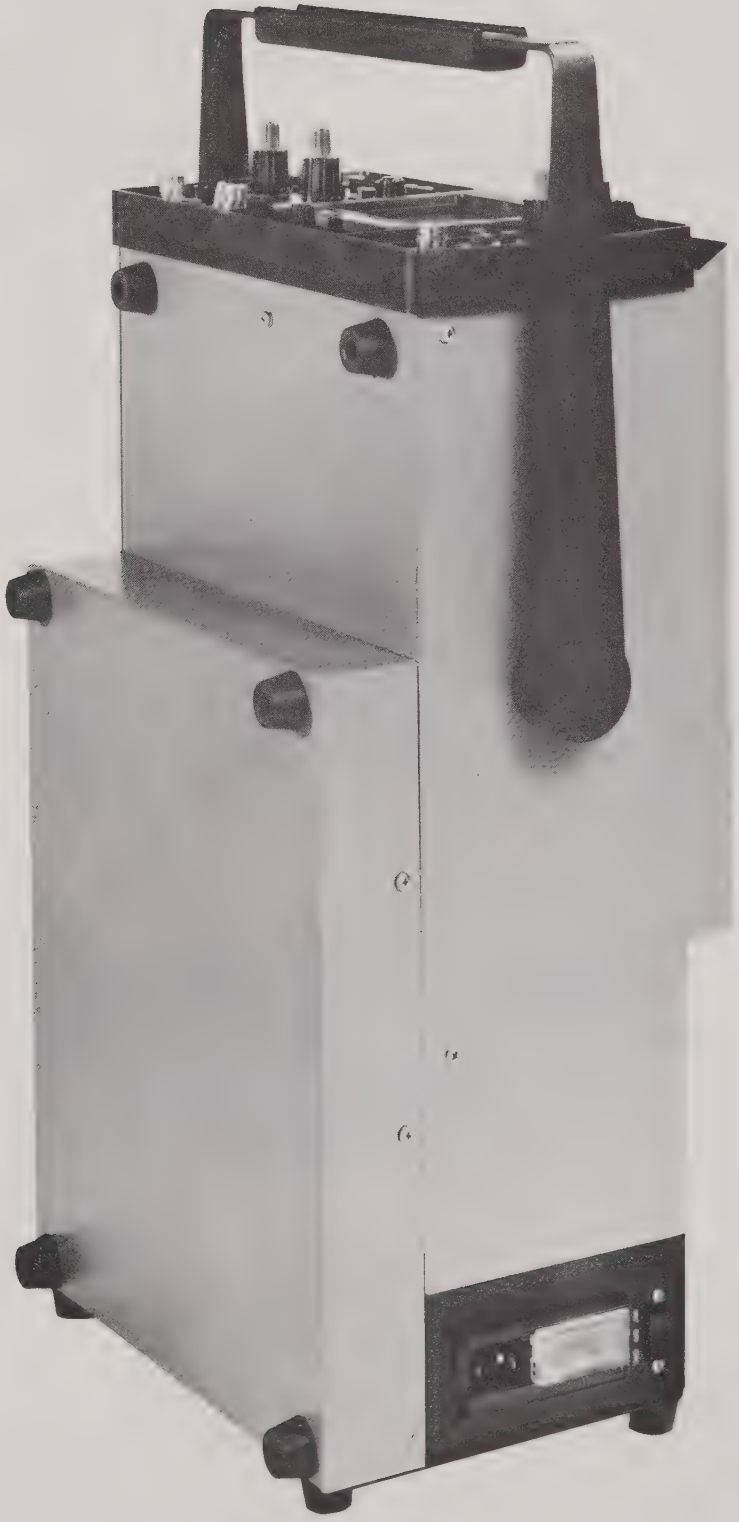

Figure 1-5. PS950/975 with Option PS9310 Battery Pack/AC-DC Power Supply

1-22. SPECIFICATIONS

PS950 MINI-SCOPE

VERTICAL DEFLECTION

BANDWIDTH: DC to greater than 50 MHz within 3 db.
COUPLING: AC, DC or Ground, selectable. Low frequency limit with AC coupling is less than 2 Hz.
RISE TIME: Less than 7 nsec.
DEFLECTION FACTOR: 5 mV/DIV to 10 V/DIV in 11 calibrated ranges, 1-2-5 sequence; all ranges accurate to within 3% with vernier in calibrate position. Vernier: Continuously variable between ranges; extends maximum deflection factor to approximately 25 V/DIV.
DISPLAY MODES: Channel 1 only; Channel 2 only (normal or inverted); Alternate; Chopped (approximate 1 MHz rate); Addition (subtraction with Channel 2 inverted); X-Y.
DELAY LINE: Allows leading edge of signal to be displayed; approximate 100 nsec delay.
INPUT R AND C: 1 Mohm within 2% paralleled by approximately 30 pF.
MAXIMUM INPUT VOLTAGE: 400 V (DC + peak AC).

HORIZONTAL DEFLECTION

TIME BASE: 100 nsec/DIV to 500 msec/DIV in 21 calibrated ranges, 1-2-5 sequence; all ranges accurate to within 3% F.S. over center 8 divisions and 5% F.S. over 10 divisions, with vernier in calibrate position. Vernier: Continuously variable between ranges; extends slowest sweep rate to approximately 1.25 sec/div.
X10 MAGNIFIER: Expands sweep rate selected by factor of 10 (extends fastest sweep rate to 10 nsec/DIV; accurate to within 5% F.S. over center 8 divisions, with vernier in calibrate position.
EXTERNAL INPUT:
Bandwidth: DC to greater than 100 KHz within 3 db.
Coupling; Deflection Factor; Input R and C; and Maximum Input Voltage: Same as for VERTICAL DEFLECTION.

TRIGGER

RANGE: DC to 50 MHz.
MODES: Automatic or Normal, with trigger level adjustment, "+" or "-" slope selection. Automatic operation is functional above 40 Hz, and provides a bright baseline at all sweep rates with no input.
SOURCES: Internal Channel 1, Internal Channel 2, combination of Channel 1 and Channel 2 (determined by DISPLAY MODES), and external.
COUPLING: DC, AC, HF Reject, AC LF Reject, and combined HF and LF Reject for both internal and external triggering.
AMPLITUDE REQUIREMENTS: 0.4 div deflection internal or 200 mV external to 5 MHz, increasing to 1.5 div deflection internal or 1 V external at 50 MHz. Requirements increase below 30 Hz with AC coupling, below 16 kHz with AC LF Reject coupling, and above 100 kHz with HF Reject coupling.
EXTERNAL INPUT R AND C: 1 Mohm within 2% paralleled by approximately 47 pF.
MANIMUM INPUT VOLTAGE: 200 V (DC + peak AC).

DISPLAY

CRT: Flat-faced rectangular with an 8 x 10 DIV display area; each DIV is 1/4 inch. CRT employs low power filament to enhance battery operation. P31 phosphor normally supplied.
GRATICULE: Black; internal, vertical and horizontal centerlines marked in 5 minor divisions per major 1/4 inch divison. 10 and 90 percent reference lines included.

ENVIRONMENTAL (DMM-COUNTER INCLUDED)

AMBIENT TEMPERATURE: Operating; 0°C to +50°C. Non-operating: -55°C to +75°C without batteries; -40°C to +60°C with batteries. Charging: +5°C to +40°C.
ALTITUDE: Operating: 15,000 feet maximum. Non-operating: 50,000 feet.
SHOCK AND VIBRATION: Will withstand the shock and vibration conditions encountered in normal commercial shipping and handling.
HUMIDITY: Will operate in up to 95% relative humidity, non-condensing.

GENERAL

PROBE COMPENSATOR/AMPLITUDE CALIBRATOR: 4 V p-p accurate to within 3%, approximate 1 kHz pulse waveform. Output impedance approximately 1.5 Kohms.
PROBES: Standard oscilloscope probes can be employed (passive, less than 100 MHz bandwidth).
Option PS9008 Switchable 10:1/1:1 Probe Kit available.
POWER SOURCES (DMM-COUNTER INCLUDED):
External AC source: Operates from an external AC source of 100 V, 120 V, 220 V, or 240 V ± 10% (externally selectable); 50 Hz to 400 Hz; 35 watts maximum.
Self-contained DC source: Option PS9310 Battery Pack/AC-DC Power Supply provides up to 2.5 hours of operating time; recharging circuitry is included which has current limiting to protect batteries from overcharge; 45 watts maximum. Unit can be operated from external DC source of 10 V to 16 V, 2 amps maximum by removing battery pack.
DIMENSIONS AND WEIGHTS (DMM-COUNTER INCLUDED):
Height: 4.2" (10.67 cm); add 1.0" (2.54 cm) for DMM-Counter; add 1.0" (2.54 cm) for Option PS9310 Battery Pack/AC-DC Power Supply.
Width: 8.5" (21.59 cm).
Depth: 15.4" (39.12 cm).
Weight: 14 lbs (6.4 kg); add 1 lb (0.5 kg) for DMM-Counter; add 6 lbs (2.7 kg) for Option PS9310 Battery Pack/AC-DC Power Supply; add 5 lbs (2.3 kg) for shipping.

975 DMM-COUNTER

DMM

OPERATING MODES:
"AUX DMM": Selectable AC volts, DC volts and Ohms using DMM input terminals.
"SCOPE": AC volts and DC component of signal displayed on CRT Channel 1 using scope BNC input connector; scope AC/DC input coupling selector switch programs DMM for AC or DC, respectively.
FULL SCALE RANGES:
AC and DC: 1.999, 19.99 and 1000. volts; AC is average reading, calibrated in terms of RMS.
Ohms: 1.99, 19.99, 199.9 and 1999. Kohms.
MAXIMUM INPUT/OVERLOAD VOLTAGE:
AC and DC: 1000 V (DC + peak AC); 400 V (DC + peak AC) using scope input.
Ohms: 50 V (DC + peak AC).
RANGING: Automatic; up-ranges at 1999 and down-ranges at 0100. Display flashes in "Ohms" mode during overrange condition.
ACCURACY:
AC: Within 0.5% of reading ± 5 digits.
DC and Ohms: Within 0.5% of reading ± 1 digit.
INPUT IMPEDANCE: 10 Mohms; 1 Mohm using scope input.
AC BANDWIDTH: 30 Hz to 5 kHz.
POLARITY: Automatic.
OHMS CONVERTER TEST CURRENTS: 1 mA, 100 uA, 10 uA and 1 uA.
DC NORMAL MODE REFECTION: 60 dB minimum at 60 Hz.
GROUNDING: DMM signal low tied to scope chassis.

COUNTER

INPUT CONFIGURATION: Counter measurement is frequency of synchronized signal displayed on CRT Channel 1 or Channel 2, selectable, in scope "internal trigger" mode, or frequency of external signal is scope "external trigger" mode. Mode, level, slope polarity and input coupling selection provided by scope trigger controls.
FULL SCALE RANGES: 9.999 KHz, 99.99 KHz, 9.999 MHz and 50.00 MHz.
RANGING: Manually selected; display flashes during out-of-range condition; 100% overrange capability provided.
ACCURACY: Within 0.1% of reading ± 1 digit.
GATE TIMES: 1 second for 9.999 KHz range and 100 msec for all other ranges.
SENSITIVITY: Counter triggered by constant amplitude pulses from scope horizontal circuit trigger generator over DC to 50 MHz range; hence, counter sensitivity for any waveform is same as scope trigger amplitude requirements. Optimum sensitivity is 7.5 mV p-p (2.7 mV RMS) at 50 MHz.
MAXIMUM OVERLOAD VOLTAGE: 200 V (DC + peak AC).
INPUT IMPEDANCE: 1 Mohm within 2% paralleled by approximately 47 pF.

GENERAL

DISPLAY: Separate 4-digit, magnified calculator size displays provided for DMM and Counter.
TIME BASE: DMM and counter operate from a crystal controlled 3.2768 MHz clock.
AMBIENT TEMPERATURE: See scope specifications. DMM accuracy applies at 25°C ± 5°C and is derated 0.1% of reading per 10°C.
OTHER ENVIRONMENTAL: See scope specifications for altitude, shock and vibration, and humidity.
POWER SOURCES: See scope specifications.
DIMENSIONS AND WEIGHTS: See scope specifications.
ACCESSORIES: See scope specifications for included standard accessories and optional accessories; in addition, DMM test leads are included as a standard accessory.

1-23. ACCESSORIES

1-24. Standard accessories included with each unit at time of shipment. are listed in paragraph 1-10.

1-25. The Models PS950 Mini-scope and 975 DMM-Counter include a variety of optional accessories which are available to the user to assist his application where required. These include a switchable 10:1/1:1 probe kit, battery pack, viewing hood for display enhancement under high ambient light conditions, rack mount kit and accessory pouch. Refer to paragraph 1-27 for a detailed listing of these optional accessories.

1-26. ORDERING INFORMATION

1-27. A tabulation of all models and optional accessories follows. Consult the Vu-data Corporation factory directly or your local Vu-data sales office for current price and delivery information.

Model PS950 Mini-scope

Model PS950/975 DMM-Counter-Mini-scope

Model 975 DMM-Counter (must be purchased in conjunction with Model PS950 Mini-scope).

Option PS9008 Switchable 10:1/1:1 Probe Kit

Option PS9310 Battery Pack/AC-DC Power Supply (must be purchased in conjunction with Model PS950 or Model PS950/975)

Option PS9311 Viewing Hood (secures to CRT bezel to shield display from high ambient light conditions)

Option PS9312 Rack Mount Kit (for use in mounting Model PS950 Mini-scope or Model PS950/975 DMM-Counter-Mini-scope in RETMA cabinet; height: 5.25" (13.34 cm) for PS950 and 7.00" (17.78 cm) for PS950/975; width: 19.0" (38.26 cm); specify "PS9312-1" for Model PS950 and "PS9312-2" for Model PS950/975 combination)

Option PS9115 Accessory Storage Pouch (employed for storage of accessories; secures to top cover)

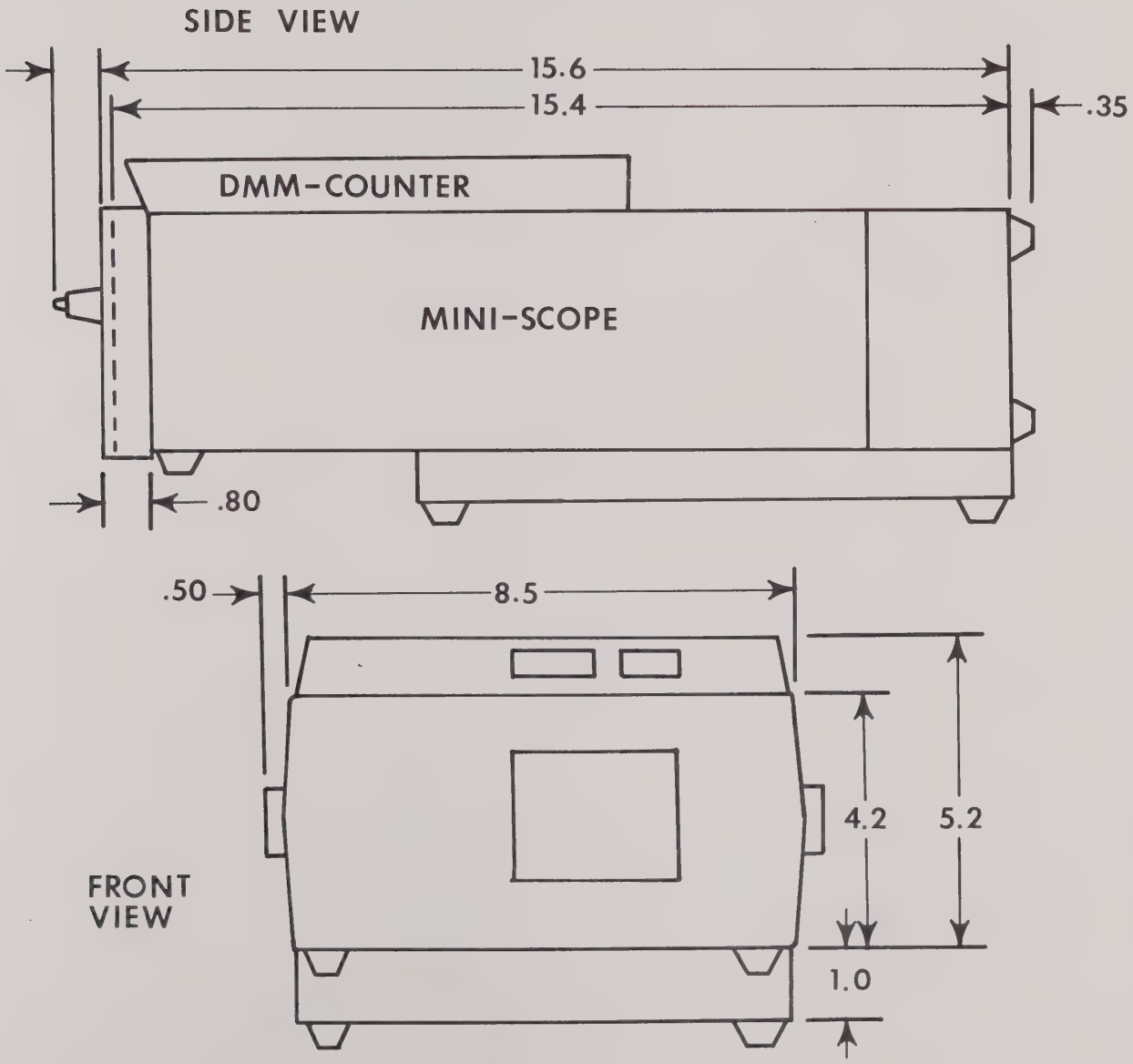

Figure 1-6. Dimensional Outline Drawing

SECTION II

INSTALLATION

SECTION II

2-1. INSPECTION UPON RECEIPT

The Model PS950/975 is aligned, calibrated, and tested under severe environmental conditions prior to shipment. The instrument is therefore ready for immediate use upon receipt. The following checks should be made however, to assure that the instrument has suffered no damage in shipment.

a. A visual inspection of the shipping container should be accomplished prior to acceptance from the carrier. If extensive damage of the shipping container is evident, a description of the damage should be noted on the carrier's receipt and signed by the carrier's agent. If damage is not apparent until the instrument is unpacked, a claim for concealed damage should be placed with the carrier within 15 days of receipt. All shipping containers and filler material must be kept for inspection.

b. A visual inspection for damage should be accomplished upon removing the instrument from the shipping container. Remove the top and bottom covers and check for loose or broken components.

2-2. BATTERY OPERATION

The battery pack is composed of two 6 volt batteries connected in series to supply 12 volts DC. The individual cells are completely sealed and require no maintenance other than periodic charging. Over (200) charge-discharge cycles can be expected before the batteries must be replaced. To operate the PS950/975 on batteries, unplug the AC power cord and use the switch on the side of the instrument to control power on-off. To recharge the batteries connect the AC line cord to the instrument and the power line, and place the switch to the charge position. The battery pack should be charged for 16-20 hours for full recovery. The battery pack is trickle charged when the PS950/975 is operated from the AC line.

a. Remove the battery pack cover to obtain access to the batteries. The battery pack cover is secured by four 4-40 screws, two on each side.

b. Remove the battery connector plug from the insulated transport standoffs and insert into the PS950 mini banana jacks. Correct polarity must be observed (black to black & red to red). Reinstall battery pack cover.

The battery pack may be received in a partially discharged condition due to time of shipment and handling before receipt. The battery pack should be recharged overnite before attempting to utilize its maximum operating time. The front panel power on light does not come on when the battery is being charged.

An external source of DC, other than the battery pack, may be used to operate the Model PS950. This external DC source should be between 10 volts and 16 volts, approximately 12 watts. Be sure to observe the proper polarity since the Model PS950 internal power supply is protected against the wrong external DC polarity by a clamping diode and fuse. The wrong connection will blow the fuse. The external DC input lines are insulated from the Model PS950 chassis ground and either the plus or minus DC lines may be connected to chassis ground without problem. The Model PS950 panel power switch will turn the instrument on and off when an external DC source is used.

SECTION III

OPERATION

SECTION III

3-1. OPERATION INSTRUCTIONS

3-2. FRONT PANEL CONTROL FUNCTIONS AND CONNECTIONS

The front panel of the PS950 Oscilloscope is divided into four sections. These sections are as follows: Vertical Section, CRT Controls Section, Horizontal Section, DMM-Counter Section.

3-3. VERTICAL SECTION

3-4. CHANNEL 1 CONTROLS

Refer to Fig. 3-1 for control locations.

a) Ch 1 Input — BNC connector - signal input for Ch 1. Impedance is 1 Megohm paralleled by approximately 30pf. This is also the input to the DMM, when the SCOPE button on the DMM is depressed.

b) AC-DC-GND — Push-buttons - controls the signal coupling to the vertical attenuator, either in a direct (DC) or capacitive (AC) mode. The third position (GND), grounds the vertical attenuator input without grounding the input signal. With the DMM in SCOPE mode, this switch also controls the function of the DMM, AC volts in AC, DC volts in DC, and a grounded input to the DMM in GND.

NOTE: Do not exceed 400VDC + peak AC vertical input signal.

c) VOLTS/DIV — Eleven position rotary switch which selects fixed vertical deflection factors from 5mV/DIV to 10V/DIV in a 1-2-5 sequence. Vernier: Red concentric knob provides a variable deflection factor when moved out of the CAL (pushed in) position. It provides for overlapping deflection factor and extends the 10V/DIV range to approximately 25V/DIV.

d) POS — Positions the CHANNEL 1 trace vertically on the CRT, and also controls the vertical trace position in the ADD mode.

e) GND Connector — Provides a convenient place to obtain chassis ground.

3-5. CHANNEL 2 CONTROLS

a) Ch 2 Input (X-IN) — BNC Connector - signal input for Channel 2. Impedance is 1 Megohm paralleled by approximately 30pf.

b) AC-DC-GND — Push buttons - controls the signal coupling to the vertical attenuator, either in a direct (DC), or capacitive (AC) mode. The third position (GND), grounds the vertical attenuator input without grounding the vertical signal input.

NOTE: Do not exceed 400VDC + peak AC vertical input signal.

c) VOLTS/DIV — Eleven position rotary switch which selects fixed vertical deflection factors from 5mV/DIV to 10V/DIV in a 1-2-5 sequence. Vernier: Red concentric knob provides a variable deflection factor when moved out of the CAL (pushed in) position. It provides for overlapping deflection factor and extends the 10V/DIV range to approximately 25V/DIV.

d) POS — Positions the CHANNEL 2 trace vertically on the CRT. The control is electrically centered and disabled in the ADD mode.

e) NORMAL- INVERT — Two position switch which selects zero degrees (NORMAL) or 180 degrees phase shift (INVERT) of the CHANNEL 2 input signal.

3-6. DISPLAY MODE SWITCH AND TRIGGER SELECT SWITCH

a) DISPLAY MODE Switch (CH1-ALT-ADD-CHOP-CH2-X-Y) — A six position push button switch which controls the mode of operation. CH 1 position selects CHANNEL 1 only. ALT provides dual trace operation with sweeps alternating between CHANNEL 1 and CHANNEL 2. In CHOP, the CHANNEL 1 and CHANNEL 2 signals are electronically switched at a 1 MHz rate to provide dual trace operation. In the ADD mode, CHANNEL 1 signal is added algebraically to CHANNEL 2 signal. Vertical positioning for this mode is provided by the CHANNEL 1 POS control. CH 2 position selects CHANNEL 2 only. In the X-Y mode, the CHANNEL 2 signal, after positioning, is routed to the horizontal amplifier. X positioning is done by CHANNEL 2 POS control.

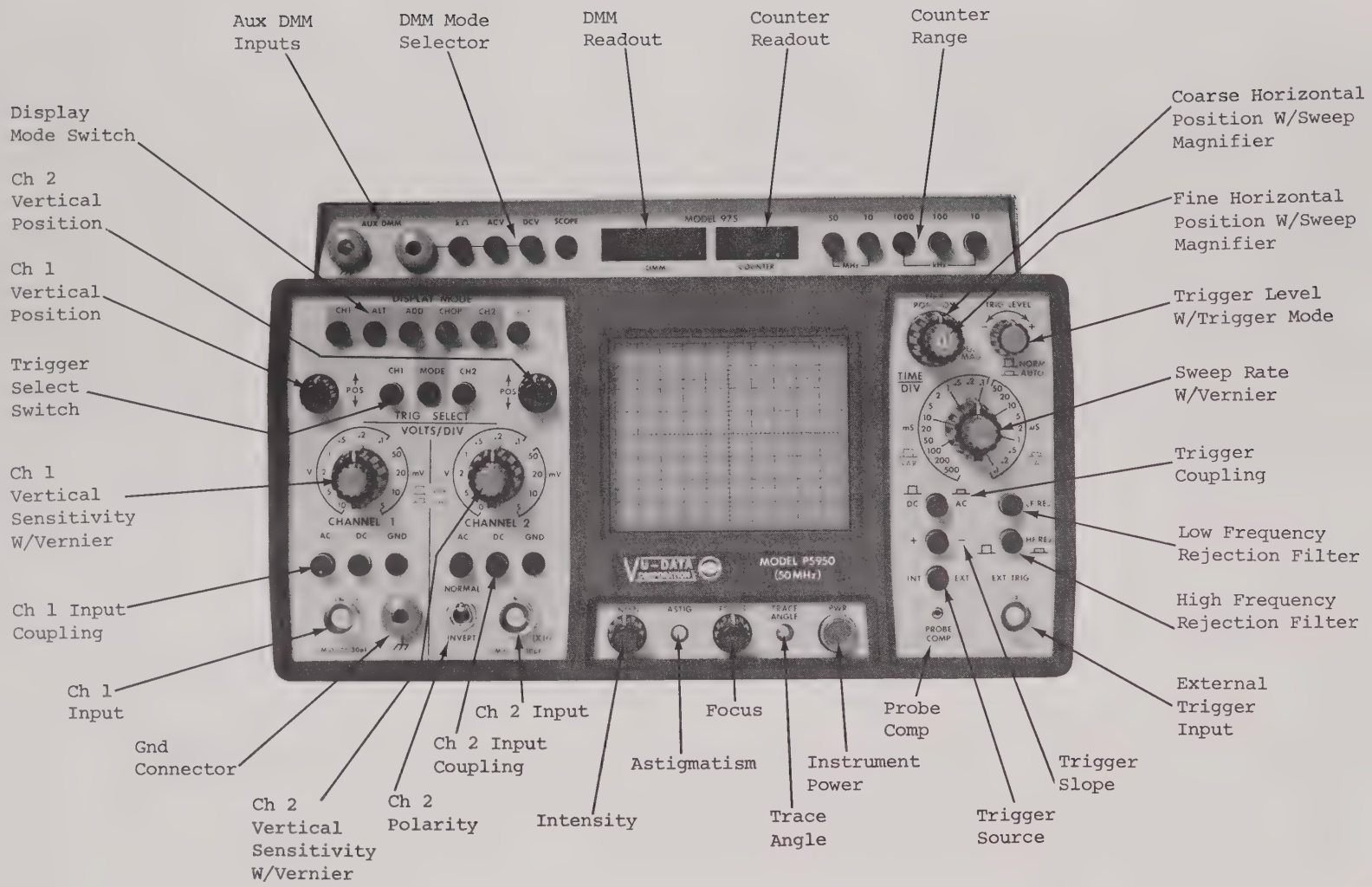

Figure 3-1. Location of Front Panel Operating Controls Model PS950/975

b) TRIG SELECT (CH1-MODE-CH2)

A three position push button switch which controls the selection of the trigger signal that will be used to initiate the sweep. In CH 1 position, the trigger signal will come from CHANNEL 1 only. In the MODE position, the trigger signal will conform to the setting of DISPLAY MODE. CH 1 position selects trigger signal from CHANNEL 1. ALT position, trigger signals will alternate between CHANNEL 1 and CHANNEL 2. ADD position, algebraic addition of CHANNEL 1 and CHANNEL 2 trigger signals. CHOP, algebraic addition of CHANNEL 1 and CHANNEL 2 trigger signals. In CH 2 position, trigger signal from CHANNEL 2 only. In X-Y, trigger and sweep generator are disabled.

3-7. CRT CONTROLS SECTION

a) INTEN

Controls the intensity of the CRT display.

b) ASTIG

Screwdriver adjustment through the front panel for control of trace astigmatism.

c) FOCUS

Controls the focus of the CRT display.

d) TRACE ANGLE

Screwdriver adjustment through the front panel which controls the horizontal angle of the trace relative to the graticule.

e) PWR

A "Power On" indicatior light.

An ON-OFF, two position switch is located on the right rear side panel for the AC version. An ON-OFF-CHG, three position switch is used for the battery pack version. (See section 3-23 for battery operation.)

3-8. HORIZONTAL SECTION

a) EXT TRIG

BNC connector - external trigger signal input, impedance is 1 Megohm.

b) INT-EXT

Push-push switch used to select the trigger signal, either from the trigger BNC Input or from the internal vertical channel.

c) +/-

Push-push switch allows control of the desired slope of the trigger signal.

d) AC-DC

Push-push switch which controls the coupling of the trigger signal in either direct (DC) or capacitive (AC) coupling.

e) HF REJ — Push-push switch which inserts a single, low pass RC filter into the trigger line (pushed in) or filter bypassed (extended).

f) LF REJ — Push-push switch which inserts a single, high pass RC filter into the trigger line (pushed in) or filter bypassed (extended).

NOTE: Both filters may be inserted for a bandpass filter.

g) TRIG LEVEL — Controls the point on the trigger signal waveform at which the horizontal sweep will start.

h) AUTO-NORM — A push-pull switch connected to the TRIGGER LEVEL control. In the NORM (extended) position, the low frequency oscillator that provides the baseline in the absence of a signal is disabled. In the AUTO (pushed in) mode, normal trigger signals will override the bright baseline oscillator at frequencies above 40 Hertz.

i) TIME/DIV — Twenty-one position rotary switch provides the calibrated sweep ranges from 100 nanosec/div to 500 millisec/div. Vernier: Red concentric knob of TIME/DIV switch slows down the sweep speed in the uncalibrated (pulled out) position, by rotating the red knob. Simply push red knob back in to return to the calibrated mode.

j) POSITION — Outside black knob controls coarse positioning of the horizontal CRT display.

k) FINE — Red concentric knob controls fine positioning of the horizontal CRT display.

l) X10 — Push-pull switch connected to the fine positioning control. In the extended position (out) the sweep rate is ten (10) times faster than indicated on the TIME/DIV switch. With the knob pushed in, normal X 1 sweep rates are obtained.

m) PROBE COMP — Tip jack provides a 4 volt P-P, 1kHz square wave for calibrating input probes.

3-9. DMM-COUNTER SECTION

a) AUX DMM Input — Banana jacks provide auxiliary input for the KOHM, ACV or DCV positions of the 4 position mode switch.

b) KOHM — Push-button switch puts the DMM in ohms measurement mode using the AUX DMM input connector.

c) ACV — Push-button switch puts the DMM in AC volts measurement mode using the AUX DMM input connector.

d) DCV — Push-button switch puts the DMM in DC volts measurement mode using the AUX DMM input connector.

e) SCOPE — Push-button switch puts the DMM in volt measurement mode. DC volts or AC volts is selected by CH 1 vertical input coupling switch (AC-DC-GND). Input to the DMM is the signal at CH 1 BNC connector. Input impedance is the scope input impedance, 1 megohm paralleled by approximately 30pf.

CAUTION: Remember that the DMM is part of the oscilloscope, and the oscilloscope signal low is chassis ground. Leaving the oscilloscope tied to ground and trying to use the AUX DMM inputs to measure a voltage not referenced to the same ground, will short the AUX DMM low lead to chassis ground.

When measuring a floating voltage with the AUX DMM leads, you must use the same procedure as used when floating an oscilloscope above ground.

f) COUNTER RANGE SWITCH (MHz-kHz) — Five push-button switch used to select the desired range for the counter. Full scale ranges are 10kHz (9,999Hz) to 50 MHz.

NOTE: The 975 counter displays the frequency of the signal used as the oscilloscope trigger signal, which can be INT-EXT,AC-DC, +/-. The oscilloscope display must be stable in order to obtain a meaningful reading of the counter. At high frequencies, the oscilloscope may appear to have a stable display but the counter will not be giving the proper readout. The TRIG LEVEL control should be used as a counter sensitivity adjustment to properly sync to the signal.

3-10. FIRST TIME OPERATION

The following procedure is provided to assist the operator in becoming familiar with the operational functions of the controls and to provide a practical operational procedure for testing the oscilloscope.

a) Inspect the power line input module for proper line voltage selection and proper fuse size. The voltage of operation for the oscilloscope, can be read on the printed circuit card inside the power receptacle block. This card is removeable and the operational

voltage is readable in the left notch of the block. Connect the power cord to the receptacle and to a convenient power outlet. Depress the power switch and allow several minutes for the CRT to warm up.

b) Set the front panel controls as follows:

AC-DC-GND	CHANNEL 1-GND, CHANNEL 2-GND
VOLTS/DIV	CHANNEL 1-1V/DIV, CHANNEL 2-1V/DIV
Vertical Vernier	CHANNEL 1-pushed in, CHANNEL 2-pushed in
Vertical Position	CHANNEL 1-Midrange, CHANNEL 2-Midrange
NORMAL-INVERT	NORMAL
DISPLAY MODE	CH 1
TRIG SELECT	CH 1
Trigger Source	INT
Trigger Slope	+
Trigger Coupling	DC
LF REJ	Out
HF REJ	Out
TIME/DIV	.2mSec
Vernier	Pushed in
Coarse Horizontal Position	Midrange
Fine Horizontal Position	Midrange
X 10	Pushed in
TRIG LEVEL	Midrange
NORM-AUTO	Auto (pushed in)

If instrument is equipped with model 975 DMM-COUNTER:

KOHM-AC-DC-SCOPE	SCOPE
Counter Range	10kHz

c) Rotate the INTEN control until a horizontal line appears. Adjust the INTEN control, the FOCUS control and the ASTIG control for a suitable display.

d) Adjust Ch 1 Vertical Position for center screen display and Horizontal Position for sweep start at left edge of graticule.

e) Rotate the TRACE ANGLE control so that horizontal line is parallel to the graticule lines on the CRT.

f) Using the X1 probe, connect the Ch1 Input to the PROBE COMP output.

g) Push the DC button on the Ch 1 Input Coupling switch. A four division square wave should appear on the CRT, with a frequency of approximately 1kHz. Push the AC button and the square wave should shift downward 2 divisions.

h) Rotate the Ch 1 Vertical Position control and observe that the display will move up and down on the CRT.

i) Rotate the Ch 1 Vertical Sensitivity switch CCW. The display will decrease in amplitude. Return to the 1V/DIV position.

j) Pull and rotate the Ch 1 Vernier control. The amplitude of the signal will decrease with CCW rotation. Push the Vernier back in at any point and the display will return to the calibrated position.

k) Connect the second probe, in the X1 position, to Ch 2 Input connector and connect it to the PROBE COMP output.

l) Press the CH 2 buttons on the DISPLAY MODE and TRIG SELECT switches. You will again observe a 4 division square wave on the CRT. Push the AC switch and the display should shift downward 2 divisions.

m) Rotate the Ch 2 Position control and verify that the display will move up and down on the CRT.

n) Rotate the Ch 2 Vertical Sensitivity switch CCW. The display will decrease in amplitude. Return to the 1V/DIV position.

o) Pull and rotate the Ch 2 Vernier control. The amplitude of the signal will decrease with CCW rotation. Push the Vernier back in at any point and the display will return to the calibrated position.

3-11. TRIGGER SELECT SWITCH

a) Place both Vertical Sensitivity switches to 2V/DIV range. Place the DISPLAY MODE switch to ALT and the TRIG SELECT switch to MODE. Move the 2 POS controls so that the two square wave displays are separated. Adjust the TRIG LEVEL control, if necessary, to obtain a stable display of both signals.

b) Push the GND button on Ch 1 Input Coupling switch. The trace will dim slightly but the signal for CHANNEL 2 will remain triggered. Return to AC on Ch 1 Input Coupling switch.

c) Push the GND button on Ch 2 Input Coupling switch. The trace will dim slightly but the signal for CHANNEL 1 will remain triggered. Return to AC on Ch 1 Input Coupling switch.

d) Push the CH 1 button on the TRIG SELECT switch. Push the GND button on Ch 1 Input Coupling switch. The signal for CHANNEL 2 will now free-run and adjustment of the TRIG LEVEL control will not result in a stable display. Return to AC on Ch 1 Input Coupling switch.

e) Push the CH 2 button the TRIG SELECT switch. Push the GND button on Ch 2 Input Coupling switch. The signal for CHANNEL 1 will now free-run and adjustment of the TRIG LEVEL control will not result in a stable display. Return to AC on Ch 2 Input Coupling switch.

NOTE: In the MODE position of the TRIG SELECT switch, the trigger signal is a combination of both CHANNEL 1 and CHANNEL 2. The signal is then controlled by the DISPLAY MODE switch in the following manner.

DISPLAY MODE Setting	Trigger Signal Origin
CH 1	Channel 1 only.
ALT	Alternating between Ch 1 and Ch 2.
ADD	Algebraic addition of Ch 1 and Ch 2.
CHOP	Algebraic addition of Ch 1 and Ch 2.
CH 2	Channel 2 only.
X-Y	Trigger signal disabled.

3-12. DISPLAY MODE SWITCH

a) Return to the MODE position on the TRIG SELECT switch and to CH 1 on the DISPLAY MODE switch.

b) The signal displayed now will be that on CHANNEL 1 only. This can be verified by moving Ch 1 Vertical Position control.

c) Push the ALT button on the DISPLAY MODE switch. The signal is now an alternating CHANNEL 1 and CHANNEL 2 display.

d) Push the ADD button on the DISPLAY MODE switch. The signal is now an algebraic addition of CHANNEL 1 and CHANNEL 2 and is twice as large as before.

NOTE: In the ADD mode of operation, the Ch 2 Vertical Position control is disabled and the display can be adjusted with Ch 1 Vertical Position only.

e) Push the CHOP button on the DISPLAY MODE switch. The signal is now a chopped display of the CHANNEL 1 and CHANNEL 2 signals. The chopper oscillator signal can be seen running through the horizontal portion of the two square wave displays.

f) Push the CH 2 button on the DISPLAY MODE switch. The display is now CHANNEL 2 only. This can be verified by moving the Ch 2 Vertical Position control.

g) Push the X-Y button on the DISPLAY MODE switch. This will result in a diagonal line from top right to bottom left. The X signal is applied to Ch 2 Input and the amplitude is controlled by Ch 2 Vertical Sensitivity switch. The X positioning is done by the Ch 2 Vertical Position control.

h) Move the Ch 2 Polarity switch to INVERT. The orientation of the line will change from top left to bottom right. This is due to the 180 degree phase shift of the CHANNEL 2 signal in the INVERT position.

3-13. TRIGGER AND HORIZONTAL CONTROLS

a) Disconnect the probes from the Ch 1 and Ch 2 Input connectors and the PROBE COMP tip jack. Push the CH 1 button on the DISPLAY MODE switch and the MODE button on the TRIG SELECT switch. Push the DC button on the Ch 1 Input Coupling switch.

b) Connect a sine wave generator to Ch 1 Input connector and set the generator frequency to approximately 1kHz. Set the amplitude control to obtain approximately full scale on the CRT. Adjust the TRIG LEVEL control until the sweep starts in the center of the display.

c) Using the DC offset control on the signal generator, move the vertical signal up or down on the CRT. Note that the sweep start point does not change in reference to the graticule.

d) Push the AC button on the Trigger Coupling control. Again, using the DC offset control on the signal generator, move the vertical signal up or down on the CRT. Note that the sweep start point now moves with the sine wave in reference to the graticule. Disable the DC offset control on the signal generator.

e) Push the Trigger Slope to the minus (-) position. The sweep start slope will change from plus to minus on the sine wave.

f) Rotate the TRIG LEVEL control. The sweep start point will ride up and down on the sine wave. The signal will free-run as the top and bottom peaks of the sine wave are reached.

g) Pull the TRIG LEVEL control knob out to the NORM position. Rotate the TRIG LEVEL control. The trace should disappear as you adjust to the top and bottom peaks of the sine wave. Reset the TRIG LEVEL control until the sweep starts in the center of the sine wave.

NOTE: In the NORM mode, the bright baseline oscillator is disabled and the CRT will go dark until a signal is applied, of sufficient amplitude, to activate the trigger generator. At input frequencies at or below 40 Hertz, it will be necessary to use this mode in order to obtain a stable display.

h) Disconnect the signal generator from the Ch 1 Input and connect it to the External Trigger Input. Push the Trigger Source button to EXT. A line will appear on the CRT.

i) Return the Trigger Source switch to INT and the TRIG LEVEL control to AUTO. Reconnect the signal generator to Ch 1 Input.

j) Push the LF REJ filter in. Note that the amount of adjustment of the TRIG LEVEL control is very small to maintain a stable display. Return the filter to the extended position.

k) Set the signal generator frequency to approximately 500kHz and the TIME/DIV switch to 1uS range. Push the HF REJ filter in. Note that the amount of adjustment of the TRIG LEVEL control is very small to maintain a stable display. Return the filter to the extended position.

NOTE: The HF REJ and LF REJ filters are both single RC filters inserted into the trigger line. The LF REJ filter will start to attenuate at 16kHz and lower. The HF REJ filter will start to attenuate at 100kHz and higher. With both filters inserted, a bandpass filter between these two frequencies can be selected.

l) Rotate the TIME/DIV switch CCW and note that the amount of displayed sine wave cycles increases with each switch position. Set the TIME/DIV switch to the .2mS position. Set the signal generator to approximately 5kHz.

m) Pull and rotate CCW the Vernier control on the TIME/DIV switch. Note that the sweep time decreases and more sine waves appear within the graticule. Push the Vernier in at any position and the sweep rate will return to the calibrated position.

n) Note that there are 10 negative peaks of the sine wave displayed within the graticule. Pull the Sweep Magnifier control out, this is part of the Fine Horizontal Position control. There will be only one cycle of the sine wave displayed within the graticule. Push the Sweep Magnifier control back in.

o) Rotate the Coarse Horizontal Position control, the display will move horizontally on the CRT.

p) Rotate the Fine Horizontal Position control, the horizontal display will move 1 division for full travel of the control. This provides fine positioning in the expanded mode.

3-14. MODEL 975 DMM-COUNTER

a) Connect the X1 probe to Ch 1 Input connector and to the PROBE COMP tip jack. The DMM display will read approximately 2.00VDC.

b) Push the AC button on Ch 1 Input Coupling switch. The DMM will now read approximately 2.23VAC.

c) Connect the red DMM auxiliary input cable to the red AUX DMM banana jack. Connect the red probe to the PROBE COMP tip jack. Push the AC button on the DMM mode selector switch. The DMM will read approximately 2.23VAC.

d) Push the DC button on the DMM Mode Selector switch. The DMM will read approximately 2.00VDC. Disconnect the red probe from the PROBE COMP tip jack.

e) Push the KOHM button on the DMM Mode Selector switch. The DMM display will up-range and then start flashing. This flashing

display is an over-range condition for the DMM and in the KOHM mode, it is normal.

f) Connect the red probe to the green AUX DMM banana jack. The DMM will now indicate .000.

NOTE: In the SCOPE mode of operation, the DMM is connected directly to Ch 1 Input. The input impedance is now the same as for the oscilloscope.

g) Connect the sine wave generator to Ch 1 Input. Adjust the TRIG LEVEL control, if necessary, for a stable display. The counter will read out the frequency of the sine wave oscillator.

h) Move the signal generator to Ch 2 Input. The counter will now read 00.00.

i) Push the CH 2 button on the TRIG SELECT switch. The counter will now read the frequency of the sine wave generator. Note that you do not have a display on the CRT. Push the CH 2 button on the DISPLAY MODE switch. You will now have your display on the CRT.

NOTE: The signal that is driving the counter, is the output of the trigger generator. In order to have an accurate and reliable count, the trigger signal must come from CHANNEL 1 or CHANNEL 2. The TRIG LEVEL control must be adjusted for a stable display.

3-15. INPUT SIGNAL PROBES

When X10 Probes are used with the vertical inputs, they must be adjusted to compensate for the time constant of the input of each input. The PROBE COMP output may be used to provide the 1kHz square pulse signal. If you are using another square wave source, it is important to remember not to exceed a frequency of 5kHz, or the amplitude of the display will change while making the adjustment.

3-16. CHANNEL 1 OR CHANNEL 2 OPERATION

The two channels may be operated as separate vertical amplifiers. Selection of display is controlled by selecting CH 1 or CH 2 on the DISPLAY MODE switch. The proper trigger signal can then be selected by the TRIG SELECT switch. In the MODE position, the trigger signal is controlled by the DISPLAY MODE switch. By pushing the desired position, the proper signal will be fed to the trigger generator.

Each channel has its own Vertical Sensitivity control (VOLTS/DIV) and its own Vernier. This switch is accurate when the Vernier is in the calibrated (pushed in) position. The Vernier allows for variable and overlapping adjustment of the Vertical Sensitivity.

The Input Coupling switch for each channel is used to select the mode of coupling desired, in the AC mode, the low frequency corner is about 2Hz. Do not exceed 400VDC + peak AC when this switch is in the AC mode.

3-17. ALTERNATE TRACE OPERATION

Dual trace operation is selected by pushing the ALT button on the DISPLAY MODE switch. In this position, the trace alternates between CHANNEL 1 and CHANNEL 2. In the MODE position, the timing relationship of the two signals cannot be determined due to the alternate switching of the trigger signal.

3-18. CHOPPED MODE OF OPERATION

In the chopped mode of operation, the electronic chopper oscillator operating at a frequency of about 1MHz, alternately selects CHANNEL 1 and CHANNEL 2 vertical signals and connects them to the vertical output amplifier. Each signal is alternately sampled for about ½ microsecond interval and displayed, as the trace sweeps horizontally across the CRT.

With the TRIG SELECT switch in the MODE position, the trigger signal is an algebraic addition of CHANNEL 1 and CHANNEL 2.

3-19. ADD MODE OF OPERATION

In the ADD mode of operation, CHANNEL 1 and CHANNEL 2 signals are algebraically added. To subtract CHANNEL 2 from CHANNEL 1, place the Ch 2 Polarity switch to INVERT. Only Ch 1 Vertical Position can be used in this mode since Ch 2 Vertical Position is disabled.

With the TRIG SELECT switch in the MODE position, the trigger signal will also be an algebraic addition. If the vertical signals are added, the trigger signals will be added. If the vertical signals are subtracted, the trigger signals will be subtracted.

3-20. X-Y MODE OF OPERATION

To activate X-Y operation, the X-Y button on the DISPLAY MODE switch is depressed. In the X-Y mode, normal Y signals are connected to Ch 1 Input and displayed on the CRT. The X signal is applied to Ch 2 Input. The CHANNEL 2 signal is connected to the horizontal amplifier. The Ch 2 Vertical Sensitivity control is used to control the X signal gain. Ch 2 Position is used to position the signal horizontally on the CRT. If the Ch 2 Polarity switch is placed to INVEPT, the phase relation compared to CHANNEL 1, will be shifted 180 degrees. In this mode of operation, the trigger circuit, trigger generator and sweep generator are disabled.

3-21. HORIZONTAL DISPLAY

The horizontal time base is controlled by a 21 position rotary switch, a Vernier control and a X10 Sweep Magnifier. The calibrated ranges are selected by the rotary switch and the Vernier control allows these ranges to become variable by pulling out on the Vernier control. Rotation of the Vernier control allows for variable and overlapping ranges.

With the Sweep Magnifier in the X1 position (pushed in) normal sweep settings may be read directly from the TIME/DIV switch. With the Sweep Magnifier activated (pulled out) these settings decrease by a factor of 10.

3-22. CRT CONTROLS

The intensity of the display is controlled by the INTEN control. The INTEN control should be set to a normal display when adjusting the FOCUS and ASTIG control. The FOCUS will change with the INTEN control set to maximum. The ASTIG is a screwdriver adjustment through the front panel. A sine wave display is best for adjusting the FOCUS and ASTIG control. The TRACE ANGLE control is a screwdriver adjustment through the front panel. This adjustment should be done with both vertical inputs grounded. Adjust the control until the horizontally displayed line is parallel with the graticule lines on the CRT.

3-23. BATTERY OPERATION

The battery pack version of the Model PS950 is operationally the same as the AC version with the following minor exceptions.

a) The two position rocker switch located on the right rear side panel is replaced with a three position rocker switch. In the ON position the instrument is powered, and if the AC line is connected, the battery is recharged. In the OFF position no power is supplied to any portion of the instrument. In the CHG position power is supplied only to the battery charger.

b) Two mini-banana jacks are provided on the bottom of the instrument to supply external DC Power to the instrument (either in the form of the battery pack or an external DC source).

CAUTION: Do not reverse polarity to the EXT DC POWER jacks or the charger protection fuse will open, requiring replacement.

SECTION IV

THEORY OF OPERATION

Section IV

4-1. GENERAL

The circuitry for the PS950 Oscilloscope is contained on eight printed circuit boards. Four of these boards are of the modular construction type and can be removed for circuit tracing or troubleshooting. The two vertical attenuators are contained on the Vertical Input board. The Vertical Signal board contains the two positioning stages, two chopper/summing stages, the chopper oscillator and the alternate flip-flop. Trigger select logic is also controlled from this board. The Vertical Interconnect board contains the delay line driver and the Vertical Output board contains the amplification necessary to drive the vertical plates of the CRT. The low voltage power supplies are mounted on the rear of the instrument and shielded from the instrument by a sub-rear panel. Power is routed to the instrument through a plug-in connector. The High Voltage board is located on the bottom of the instrument. Included on this board are the intensity and blanking control circuitry. This board also serves as an interconnect between the CRT controls circuit board and the CRT socket. The Horizontal board contains the trigger generator, the sweep generator and its associated circuitry and the amplifiers necessary to drive the horizontal plates on the CRT. Control circuity is also included for the X-Y Mode of operation.

4-2. VERTICAL INPUT BOARD (CHANNEL 2)

The signal applied to BNC connector J102 is routed through R65, in the DC Mode, or C38 in the AC Mode to the Input Coupling switch, S4. This is a two pole, three section, interlocking, push button switch, which controls the mode of coupling to the attenuator section. In the third position, ground is applied to the attenuator input. Resistor R66 connects the arm of the Input Coupling switch, through the shield, to the first wafer of the Vertical Sensitivity switch, S5a. The first four sections of the Vertical Sensitivity switch are used to standardize the input signal applied to U4 by dividing by factors of 1, 10, 100 or 1000. In the 50 mV-.2 V ranges, a 10:1 attenuator is inserted into the signal path. This attenuator is comprised of R78, R79, C50 and C51. The resistors attenuated at low frequencies for exact compensation. Capacitor C49 maintains a constant input capacity so that an external 10:1 probe may be used. In the .5-2 V range, a second 10:1 attenuator is connected in front of the first one. This attenuator, comprised of R73, R74, C43 and C44, is identical to the first one and the combined attenuation is now 100:1. C42 now maintains the constant input capacity so that an external 10:1 probe may be used. In the 5 V + 10 V ranges the front 10:1 attenuator is replaced by a 100:1 attenuator. The over-all attenuation is now 1000:1.

The output of the attenuators is applied to the gate of dual FET, U4. Diodes CR5-CR8 are limiting diodes to limit the input to the FET gate. U4 is a dual, matched, junction FET, with one side used as a current source and the second FET as a source follower.

The output signal from buffer U4 is applied to the c transistor of U5, a quad transistor array. Variable resistor, R108, is used to adjust the DC level applied to U5's d transistor so there is no DC shift when switching through the attenuator ranges. The 1-2-5 attenuator consisting of R95, R96 and R98, and the vertical vernier, R134, are connected between the emitters of the c and d transistors. The vertical vernier provides an attenuation factor of at least 2.5 thus providing overlap between vertical ranges. A second pair of emitter followers comprised of the b and a transistors of U5 serve to buffer the signal from the 1-2-5 attenuator.

The emitters of U5's b and a transistors couple directly to a differential cascode amplifier stage composed of Q6, Q7, Q8, Q9 and associated circuitry. This stage provides a gain of approximately 4 and provides the proper DC level to bias the normal-invert stage which follows.

The normal-invert stage is another differential cascode amplifier having a gain of approximately 4. The input portion of the cascode consists of two PNP transistors of U6, a quad transistor array. The output portion is actually located on the Vertical Signal board and consists of Q3, Q4, Q5, Q6 and associated circuitry. The bases of Q3 and Q4 are tied together as are the bases of Q5 and Q6. The collectors of Q3 and Q6 are paired as are the collectors of Q4 and Q5. The emitters of Q3 and Q5 are tied together as are the emitters of Q4 and Q6. This arrangement provides for Q3 and Q4 to be enabled as a pair and Q5 and Q6 to be disabled or vice versa. Control lines from the Normal-Invert switch select which pair are to be used (thereby, selecting the desired phase).

4-3. VERTICAL INPUT BOARD (CHANNEL 1)

Channel 1 is virtually the same as Channel 2 with the exception of minor variations which will be pointed out. The second set of contacts on the Input Coupling switch, S1b, contains the necessary logic signals required to program the Model 975 DMM, when the DMM is in the SCOPE Mode of operation. The +12 VDC power supply is connected to the wiper of this switch. With the CH 1 Input Coupling switch in the AC Mode, the +12 VDC logic signal is routed to the Model 975 power connector J5, to program the DMM for AC volts operation. With the Input Coupling switch in the DC or GND Mode, the +12 VDC logic signal is routed through J5, to program the DMM for DC volts operation. The voltmeter input signal routing for the DMM signal is done with a coaxial cable. The center conductor is connected to P4, which is the wiper of the Input Coupling switch. The shield is connected to P3, which is ground. When the Model 975 is installed, resistor R3 and capacitor C5 must be removed. The normal stage of Channel 1 (corresponds to the normal-invert stage of Channel 2) is a differential cascode stage with a gain of about 4. The input portion of the normal stage is identical to Channel 2 and consists of 2 PNP transistors of U3, a quad transistor array. The output portion is located on the Vertical Signal board and consists of Q1 and Q2 and associated circuitry. Q1 and Q2's collector resistors, R3 and R6 are larger than those of Channel 2 in order to provide gain control potentiometer, R5. This potentiometer allows the gain of Channel 1 to be matched to Channel 2.

4-4. VERTICAL SIGNAL BOARD

The signals from Channel 1 and Channel 2 are routed from their respective differential cascode input portions through connector J1 to the Vertical Interconnect board and through connector J2 to the Vertical Signal Board. The description of Q1 and Q2 and Q3, Q4, Q5, and Q6 is found in Section 4-2 and 4-3. The differential output signals from the Channel 1 normal stage and the Channel 2 normal-invert stage are each applied to an appropriate positioning stage. Since both positioning stages are virtually the same, Channel 2 only will be discussed. Transistors Q35 and Q38 and associated circuitry comprise the input of a differential cascode amplifier stage with a gain of approximately 2. Current sources Q36 and Q39 each draw about 5 mA from the emitters of Q35 and Q38, respectively. Since Q35 and Q38 are high-gain transistors, roughly 5 mA flows into each of their collectors. A consideration of Kirchoff's current law will show that if R95 is centered, the 5 mA for each collector is distributed as follows; Q34 and Q37 each supply 3 mA of emitter current and R97 and R98 each rob about 1 mA each. R95 supplies 3 mA through R94 and R96. When R95 is not centered, the currents of Q34 and Q37 are unbalanced accordingly. This emitter current unbalance reflects itself as a DC voltage offset at the collectors of Q34 and Q37, thus giving vertical positioning control. The emitters of Q35 and Q38 are tied together through R104 to provide differential gain to the signal from the normal-invert stage independent of positioning. The positioning stage also is involved with X-Y operation which will be discussed after the trigger summing amplifier.

The differential signal at the emitters of Q35 and Q38 is applied to the bases of Q29 and Q30, one input to the trigger summing amplifier. Q29, Q30, Q27, and Q28, a differential cascode arrangement comprise half of the trigger summing amplifier. The other half, Q7, Q8, Q9, Q10 and associated circuitry process the trigger signal from Channel 1 (emitters of Q16 and Q17). The two halves of the trigger summing amplifier share common collector resistors. The collectors of Q7 and Q27 and Q8 and Q28 are tied together and coupled through connector J2 to the Vertical Interconnect board. The actual collector resistors are located on the Horizontal board and are coupled to the Vertical Interconnect board with 75 ohm coaxial cables. The 75 ohm resistors also serve to terminate the coaxial cables. Each half of the trigger summing amplifier can be independently enabled to accomodate the various triggering requirements. Since both halves are identical, only Channel 2 operation will be discussed. The current source for the Channel 2 portion, Q31, is activated if Q32 is active. Q32 is normally activated by current flowing through R89. Q32 is de-activated when its emitter is pulled to a voltage lower than or equal to its base voltage by diode CR5. Potentiometer R84 is used to balance any offsets so that TP1 and TP2 are biased to the same common mode level.

As mentioned above the positioning stage is involved with X-Y operation. The bases of Q34 and Q37 are tied together as are Q40 and Q41, the X-Y transistors. Resistive dividers, R102,R107 and R116, R120, bias their respective transistor pairs so that each pair can be enabled. Lines from the transistor pairs to the Display Mode switch, S1, select which of the two pairs is to be enabled by pulling one set of bases to a lower voltage level than the other. For example, in all display modes except X-Y,

the line running to the bases of Q40 and Q41 is grounded by the normally closed contacts of the X-Y station S1, thus ensuring that Q40 and Q41 are disabled and Q34 and Q37 are enabled. Note that Q33, the current source for the Channel 2 Vertical positioning control, can be disabled by the Display Mode switch (ADD station) so that positioning in ADD mode is controlled by Channel 1. The operation of the Channel 1 positioning stage is a simplified version of that of Channel 2 and will not be discussed.

The chopper stages are PNP differential cascode stages having the output collectors from each channel, Q23 and Q24 and Q25 and Q26 tied together. Each input receives its respective signal from its positioning stage and lends a gain of about 2 before combining. The Chopper stages act as electronic switches, as well as gain stages, and are programmed by the Display Mode switch. Channel 2 will be discussed since both chopper stages are the same.

Current source, Q42 and associated circuitry, is biased on so that Q43 and Q44 are enabled. There are two ways that Q42 can be disabled (thus disabling the entire Channel 2 stage). The first disabling method consists of robbing Q42's emitter current through R129 and Q58, which is driven by the chopper oscillator. The chopper oscillator consists of Q52, Q53, Q54, and Q56 and associated circuitry. It runs only when current sources Q55 and Q59 are enabled by the Display Mode switch. The chopper stage can also be disabled by robbing Q42's emitter current through grounding the anode of CR6 or CR18 with the Ch 1 station or X-Y station, respectively, of the Display Mode switch. A third method of disabling the stage is employed when the Display Mode switch is in ALT. Whenever Q47 saturated (in accordance with the state of the alternate flip-flop, Q49, Q50 and associated circuitry) CR21 and CR22 rob the collector current from Q43 and Q44, disabling Q25 and Q26. The collectors of both chopper stages are tied together and share the same collector network which is found on the Vertical Interconnect board. The network consisting of R1-R6 provides for Vertical Gain Calibration and maintaining proper bias when both chopper stages are enabled in ADD.

The Display Mode switch is a 2 pole, 6 station interlocking push button switch. One pole of each station is used to program the circuits for each display mode operation. In the Channel 1 position, Channel 2 is disabled. In the ALT mode, the emitters of the alternate flip-flop and the driver transistors are grounded, allowing the hold-off signal to toggle the flip-flop. In Add mode, the Channel 2 position control is disabled and R114 and R121 are inserted to center Channel 2's positional contribution. In the CHOP mode, Q55 and Q59 are enabled allowing the chopper oscillator to switch the Channel 1 and Channel 2 chopper stages at a 1 MHz rate. In the Channel 2 position, Channel 1 is disabled. In the X-Y mode, the output portion of Channel 2's positioning stage, Q34 and Q37, are disabled and the X-Y transistors, Q40 and Q41, are enabled. A logic control signal to the Horizontal board is also activated to perform the following functions. On the Horizontal board, the trigger generator is latched in a disabled state, the TIME/DIV amplifier is disabled, the X channel amplifier is enabled, and the trigger summing amplifier (on the Signal board) is disabled.

This differential current signal is applied to complementary common base stages Q5 and Q11 on one side, and Q8 and Q22 on the other side. The output of the common base stages are coupled to emitter follower transistors Q4, Q10, Q12, and Q23 which provide buffering for the common base stages, thus achieving wider bandwidth. The emitter followers drive complementary, common emitter, push-pull output stages comprised of Q1 and Q13 on one side, and Q9 and Q24 on the other. Local feedback from Y1 and Y2 through resistors R7 and R17, respectively, to the inputs of the complementary common base stages. Capacitor C13 is adjusted to achieve the desired bandwidth (50 MHz). The remaining transistors configured with a base-collector short are "super diodes" used for biasing purposes.

4-6. HORIZONTAL BOARD

The Horizontal board contains the circuitry necessary to generate the sweep signal and amplify the signal for display on the CRT. Control logic is also used to disable the unnecessary functions not required for X-Y operation.

4-7. INTERNAL TRIGGER AMPLIFIER

The two halves of the trigger summing amplifier on the Vertical Signal board, have their collectors paralleled and share common collector resistors. The trigger signal is coupled from the Vertical Signal board to the Horizontal board by two 75ohm coaxial cables. The two collector resistors, R36 and R44, are located on the Horizontal board and serve as terminating resistors for the 75ohm lines. Two differential amplifiers on the Horizontal board amplify the trigger signal which is taken off single-ended by an emitter follower and applied to one side of the Trigger Signal Source switch, S1. The trigger signal zero control is used to adjust for 0 VDC output at the trigger source switch.

4-8. TRIGGER GENERATOR

The trigger signal source is selected by the Internal-External switch, S1c. In the EXT Mode, the trigger signal is applied to the voltage divider made up of R1 and R2, with C1 used to couple the high frequencies. The desired signal is coupled through Coupling switch, S1a, to the gate of U1. If frequency filtering is desired, the appropriate filter or filters can be inserted into the signal path. The HF REJ will start to attenuate at 16 kHz and higher. The low frequency filter will start to attenuate at 16 kHz and lower. With both filters inserted, the bandpass will fall between these two points. The signal is then applied to the gate of dual fet U1, through current limiting resistor R5. Capacitor C5 is used for the high frequency portion of the signal. The gate of the FET is protected by clamping diodes CR4 and CR5. Clampling levels are controlled by diodes CR1, CR2, CR3, CR6, CR7 and CR8. The dual FET is used to DC level shift the signal onto the second gate. Transistor Q1, is the constant current source for this stage. Transistor Q2 is a control transistor used to latch the trigger generator when in the X-Y Mode of display. The Cross-Over Balance control, R14, is used to set the trigger point symmetrically between + and slope.

The alternate poles of each station on the Display Mode switch are tied together at the wiper and connected to the MODE position of the Trigger Select switch. In the MODE position, this line is grounded allowing for the proper trigger selection to accompany the selected Display Mode position. In the CH 1 position, the Channel 2 half of the Trigger Summing amplifier is disabled. In the ALT position, two logic inverters, Q45 and Q46, are activated by grounding their emitters. These logic inverters (driven by Q47 and Q48) alternately disable appropriated halves of the trigger summing amplifier. In the ADD and CHOP position, both halves of the trigger summing amplifier are enabled, resulting in algebraic summation of the two trigger signals. In the CH 2 position, the Channel 1 half of the trigger summing amplifier is disabled.

The Trigger Select switch, S2, is a 2 pole, 3 station, interlocking push button switch. In the CH 1 position, the Channel 2 half of the trigger summing amplifier is disabled through diode, CR14. In the MODE position, ground is applied to one pole of each of the six sections of the Display Mode switch, to accomplish triggering as described above. In the CH 2 position, the Channel 1 half of the trigger summing amplifier is disabled through diode, CR17.

4-5. VERTICAL INTERCONNECT BOARD AND VERTICAL OUTPUT BOARD

The Vertical Interconnect board primarily provides for power distribution and signal routine for the Vertical Input board and Vertical Signal board. In addition, it contains the delay line driver stage.

As mentioned in section 4-4, the collector network for the chopper stages is found on the Vertical Interconnect board and consists of resistors R1-R6. Q1 and Q2 are switches that are turned on in ADD mode.

The differential signal from the chopper stages is coupled through resistors R11 and R12 to the input of the delay line driver stage. This stage is an NPN differential amplifier composed of two transistors of U1, an integrated circuit package containing four 2N3904 transistors. Resistors, R13 and R15, are the input terminating resistors for the differentially driven delay line, as well as the collector resistors for the stage. To compensate for losses in the delay line the amplifier's emitter circuitry contains, four peaking networks to tune the delay line for a flat pulse response. The delay line couples the signal (with approximately 100 nanosec delay) to the Vertical Output board where the delay lines terminates in R1.

The vertical output amplifier found on the Vertical Output board is a differential-in-to-differential-out amplifier that drives the vertical deflection plates. Local feedback is employed for gain stability and a push-pull output stage achieves low distortion at high frequencies. Transistors Q19 and Q20 are configured as a differential amplifier stage with their emitters coupled through R21, potentiometer R28, and associated circuitry, provide proper bias current for the differential stage so that Y1 and Y2 are biased symmetrically about 0 V. The difference voltage applied to the bases of Q19 and Q20 is converted by the differential action of the stage into a difference current signal at the collectors of Q19 and Q20.

The differential output signal from U1 is applied to the trigger polarity amplifier. This amplifier consists of two differential amplifiers with the collectors tied together and sharing common collector resistors. Since the inputs are cross-coupled, the phase of the output signal can be controlled by turning on the appropriate current source. This is done by the Trigger Polarity switch, S1b. The heart of the trigger generator is integrated circuit, U2. This is a differential input, differential output comparator, with TTL logic level outputs. The hysteresis level for the comparator is determined by the values of R34, R21 and R25. With a nominal output of 4.0 V, the hysteresis at the input is approximately 40 mV. One output is used as a drive signal for the Model 975 counter, with signal connections at J1 and J2. The second output is used to trigger the sweep generator.

4-9. SWEEP GATING CONTROL

The trigger signal from the trigger generator is coupled through capacitor C28, to differentiate the square wave pulse. Only the negative spikes are coupled through diode, CR15, to the base of the Schmitt trigger. Transistors Q21 and Q22, are the Schmitt trigger transistor with resistors R76, R77 and R78, setting the hysteresis. This hysteresis level is small and the base of Q21 is biased slightly above the upper level. The negative pulse from the differentiated trigger signal will start Q21 conducting. With the collector of Q21 going positive, transistor Q23 of the NPN differential stage, will start conducting. This will pull the base of Q21, through the hysteresis level and set the Schmitt trigger. The base of the second transistor of the differential stage is biased at the average voltage of transistor Q21's collector. This allows the NPN differential stage to act as a switch, used to set and hold the Schmitt trigger, once it has been initiated. The output from the Schmitt trigger is not of sufficient amplitude to drive the sweep generator circuit and so a second NPN differential stage is used. This stage, comprised of Q45 and Q46, provides not only the sweep control signal, but also the blanking control signal. This stage also is configured as a switch by referencing the base of Q46 to a fixed DC level.

4-10. BRIGHT BASELINE OSCILLATOR

The bright base line circuit is a monostable multivibrator with a time constant controlled by C25 and R61. In the absence of a trigger signal, transistor Q16 is turned off and Q17 is conducting. This forward biases the coupling diode, CR11. The NPN differential is biased so that Q18 is turned off and Q20 is conducting. With Q20 conducting, diode CR14 is forward biased. The hold-off monostable circuit will pull the base of the Schmitt trigger positive, above the upper hysteresis level. As soon as the hold-off circuit times out, the current from the constant current source Q19, passing through the differential transistor Q20, will pull the input of the Schmitt trigger back below the hysteresis level of the Schmitt trigger. This guarantees that the sweep generator will be initiated as soon as the hold-off monostable times out. The bright base line circuit can be disabled by turning off the constant current transistor. The base resistor R65, is connected to ground through switch, S303. This switch is part of the trigger level control.

By pulling the knob out, the switch opens and the current source turns off. With a trigger signal applied, the square wave from U2 output is differentiated by capacitor C24, and the negative spike is coupled through the diode, CR10, to the monostable. The first trigger pulse will initiate the timing cycle of the monostable, reverse biasing diode CR11. This switches the differential stage so that Q20 will turn off and Q18 will turn on. As long as the trigger signal repeats often enough, the monostable will not be allowed to time out, due to the negative pulses at the base of Q16. As the trigger frequency drops lower, the monostable will have more time to complete its timing cycle. At this point (approximately 25 Hz) the CRT display will become unstable since it can be triggered by either the bright baseline circuit or the trigger pulse.

4-11. SWEEP GENERATOR

The sweep ramp signal is developed by charging a fixed capacitor from a constant current source. The horizontal sweep generator uses three timing capacitors and nine different current ranges to develop the twenty-one sweep ranges. The three timing capacitors are activated by FET switches. Eight switches are biased off by biasing the gates, through steering diodes, to the negative supply. This allows for controlled activation of the desired ranges by a logic signal from the TIME/DIV switch. The +8 VDC voltage on the wiper of both wafers will reverse bias a diode at the gate of each FET switch.

The Constant Current sub-assembly contains all of the circuitry for the programmable current sources. The dual FET U1, integrated circuit U2, and source follower Q1, are used to develop a reference voltage across resistor R11. The voltage drop across resistor R11, is controlled by the voltage across resistor R1, on the input gate of the dual FET source followers. The variable resistor R304, is used to vary the voltage drop across resistor R1, and this is the vernier control of the TIME/DIV switch. When the vernier is in the calibrated position, the wiper of switch S304, is connected to ground. This causes 1.00 VDC to be applied across resistor R11, resulting in 1 uA of current. This current can be changed by activating the FET switches Q2-Q9. This parallels the selected resistor with resistor R11 and the current will change proportionately. The current flow from these resistors must flow through Q1 and the drain lead of Q1 becomes the current source point or the charge line for the timing capacitors.

Three timing capacitors are used to develop the sweep ramp voltage. Capacitors C45 and C46 are factory selected and matched to each other. The third capacitor is made up of C47, C48 and C49. The adjustable capacitor C49, allows this network to be matched to the other two capacitors. Connected across each of these timing capacitors is a diode and a FET switch. The diode prevents the capacitor from charging too far negative when it is turned off. The FET switch is used to discharge the capacitor during retrace time. The gate signal for these FET switches Q39, Q41, Q43 and Q48 comes from the NPN differential stage driven by the sweep gating Schmitt trigger.

The TIME/DIV switch also controls three pairs of FET switches used to select the appropriate capacitor. Q49, Q50 and Q51 are used to connect the desired

timing capacitor to the charge line. Q38, Q40 and Q42 are used to couple the sweep ramp signal to the dual FET buffer U3. One side of U3 is used as a source follower and the second side is used as a constant current source. This results in a 0 VDC output with a 0 VDC input at the gate. Variable resistor, R110, is used to set the reset level of the sweep ramp to 0 VDC

On the top nine ranges of the TIME/DIV switch the timing capacitor is the smallest. The fast edge of the sweep gating signal is capacitively coupled from the gate of Q43 to the drain by the internal drain-gate capacitance of Q43. This results in a negative step at the start of the sweep ramp signal. To overcome the introduction of sweep non-linearity at the sweep start point, a small part of the blanking signal is introduced into the charge line. The variable capacitor, C50, is used to eliminate the step in the sweep start wave form.

4-12. HOLD-OFF MONOSTABLE

The 0 VDC to +2 VDC sweep signal is coupled from the output of the dual FET buffer U3, to the emitter follower Q34. The emitter load resistor is connected to a constant current source transistor, Q35. This insures good linearity to the anode of coupling diode, CR21. The hold-off monostable is made up of transistors Q26 and Q32, with Q33 suppling a constant current for the monostable circuit. The two transistors of the monostable are isolated by a PNP differential stage which is wired to act as a switch by biasing the base of Q29 to a fixed DC level. The first transistor of the PNP differential stage is used to reset the Schmitt trigger sweep gating control, by pulling the base of Q21 positive, during the timing cycle of the monostable. The second transistor of the differential stage develops the signal voltage swing for second transistor of the monostable circuit. This allows for FET switching of the timing capacitors for those times when longer hold-off is required. Capacitor C34, is the basic timing capacitor for the monostable. Capacitors, C35 and C36, can be paralleled with C34 by turning on the appropriate FET switch.

4-13. HORIZONTAL POSITIONING

The sweep ramp signal from TP1 is applied to one input of a PNP differential stage. The second input is from the horizontal position controls, R301 and R302. This stage has a gain of 2.5 and combines the sweep ramp signal and positioning control signal. The position control consists of concentric potentiometers. The outside shaft controls R301, the coarse position. The fine position control, R302, is isolated from the coarse control by emitter follower Q57. Constant current source, Q58, assures a fixed position range for the fine position control. The collectors of a second PNP differential stage, Q59 and Q61, are connected to the collectors of the positioning stage. This second stage is the X signal amplifier for the X-Y Mode. The cathode end of CR33 and CR44 is the X logic control line for X-Y operation. By grounding this point, through a diode on the Vertical Signal board, the horizontal positioning stage is turned off by Q53. Diode, CR34, turns on the X signal amplifier and the signal from channel 2 position stage is passed to the horizontal amplifier.

4-14. HORIZONTAL AMPLIFIER

The signal from the horizontal position stage is amplified by the NPN differential stage consisting of Q62, Q64 and associated circuitry. This stage allows for the introduction of the X10 expander control, S302. This switch is a part of the fine position control and is activated by pulling out on the fine position knob. In normal operations, this stage has a gain of 2. In the expanded mode, this is changed to a gain of 20, by paralleling the emitter resistor with R178 and R179. The variable resistor is used to adjust this expanded gain. FETS, Q65 and Q66, are used as a switch. The two FET'S are in parallel to minimize the effects of the FET "on" resistance. The normal output signal from this stage is 10 VP-P and this signal is applied to the horizontal output amplifier. The horizontal output stage is made up of two complementary current amplifiers driven differentially by the NPN differential stage.

Each side of the horizontal amplifier is a current summing amplifier with feedback resistors R192 and R206, nulling out the current unbalance when current changes are applied to the summing point. The network consisting of Q82, R220 and R221 provides the DC biasing voltage for the two common base stages Q69 and Q70, Q73 and Q76. The current through these stages is controlled by resistors R193 and R194, R205 and R207, feedback currents through R192 and R206 and the currents through R190 and R200. An increase of current through Q79 or Q80 will result in an increase of currents through R193 or R205, respectively. This will increase the current through Q67 or Q75 and the X1 or X2 output will go positive. Since X1 or X2 has gone positive, current feedback will flow from Q67 or Q75. A proportional decrease in current will be noticed through Q71 or Q78 since there is less current through resistor R194 or R207.

Under normal operating conditions, with the inputs to the differential stage matched, the X1 and X2 output levels are set to 0 VDC. This is done by varing R217, in the current source of the differential stage. The summing junction is normally operated at a positive level while the X1 and X2 at 0 VDC potential, the lower half of the current amplifier will therefore conduct slightly more current than the top half. This can be verified by measuring the voltage drop across R196 and comparing it to the voltage drop across R187.

4-15. HIGH VOLTAGE AND CRT CONTROLS

The High Voltage and CRT Control board contains all of the circuit necessary to drive the CRT. The circuitry fulfills the two basic requirements for the tube. The high voltage generation circuitry and a blanking signal (with intensity control) to operate the CRT control grid.

The blanking signal is the out-of-phase signal from the horizontal sweep gating Schmitt trigger. This signal is amplified and phase inverted by the NPN differential stage, Q46 and Q48, on the Horizontal board. Since this signal is used to drive the blanking circuit and the alternate flip-flop, it is double buffered. Emitter follower output Q36, drives the

blanking circuit. Emitter follower Q37, drives the alternate flip-flop. These signals are coupled by coaxial cable, to insure the fast edge requirements. The load resistor for each emitter follower is located at the receiving end of their respective coaxial cables. Thus, resistor R40, is the emitter load resistor for Q36, emitter follower, and this signal is applied to one input of a differential stage. The second input is the intensity control signal from R103. Diodes CR21-CR26 are the supply voltages for the ends of the intensity control. Emitter follower Q17, provides the low impedance point necessary to drive the differential stage. The differential stage has only one output and this is the summing point of a complementary current amplifier, Q10-Q15. This current amplifier is similar to one side of the horizontal output stage. If the summing point tries to go positive, the center point of diodes CR10-CR13, will swing negative and Q11 will provide the feedback current through R34. If the summing point tries to go negative, the center point of diodes CR10-CR13 will go positive and Q10 will provide the feedback current. The four diodes CR10-CR13, in the output of the current amplifier, supply the DC bias potential for the complementary emitter follower, Q8 and Q9. This provides the low impedance required to couple the blanking signal to the control grid of the CRT.

There are two adjustments in the differential stage and these are used to set the upper and lower operating point of the blanking signal at TP2. To assure total darkness on the CRT, during retrace, the Blank Level control, R42, is adjusted for -22 VDC for the lower blanking signal at TP2. To obtain the maximum brightness from the CRT, the Intensity control is set for maximum intensity. The Bright Cal control, R47, is then set for up to +25 VDC for the upper level of the blanking signal at TP2.

The high voltage circuit is a sine wave oscillator with T1 primary being the resonant element along with capacitor, C1. The frequency of operation is approximately 20 kHz. Transistors, Q1 and Q2, along with the feedback winding are the switching elements for the oscillator. The transistors supply the current surges necessary to maintain the oscillations. During a dark CRT condition, only a small conduction angle is necessary to maintain the currents necessary in the secondary of the transformer. This point is set up by resistors R5, R6, R7 and capacitor C14. As the Intensity control is turned up, the tube will start to draw beam current. A feedback signal, obtained from the -1000 VDC supply, through the voltage divider R13, R104, R14-R17, is compared against the +8 VDC supply. Along the feedback string is the variable resistor, R16, the adjustment control for the high voltage regulator. The differential stage amplifies the changes at the wiper of R16, and turns on the emitter follower Q3. When Q3 starts to conduct, it increases the conduction angle of the switching transistors by moving the center-tap of the feedback winding of the transformer.

The high voltage secondary winding supplies the two high voltages required for the CRT. The -1000 VDC is obtained by half-wave rectifier CR1 and the Pi filter C9, R3 and C10. The +6000 VDC supply is derived from the voltage sextupler, CR2, CR3, CR4, CR5, CR29, CR30, C4, C5, C6, C7, C39, and C40. C8 is the filter capacitor and R2 is a current limiting resistor in the event of a short circuit on the +6000 VDC supply. The focus and raster

voltages are obtained by voltage dividers from the -1000 VDC supply. The Astigmatism control is connected across the +30 V and -30 V supplies. The Trace Angle control is connected across the +8 V and -8 V supplies and one end of the coil is referenced to ground.

One more supply is needed for the CRT. This is the negative variable voltage for the control grid. Referenced to the cathode, this voltage must vary with the Intensity control and it must go far enough negative to turn the tube off during retrace. A sample of the sine wave oscillator signal is taken from the collector of Q1. This is capacitively coupled through C18, to the base of Q6. This transistor is a switch, with its emitter connected to the +30 VDC supply. When Q6 conducts, the collector current is controlled by constant current source Q7, and this is set for 1 mA and referenced to the -30 VDC supply. The normal output at the collector of Q6 would be a 60 VP-P square wave at the sine wave oscillator frequency.

To control the amplitude of this square wave, the blanking pulse is coupled to the collector of Q6, through diode CR9. When the tube is cut off, TP2 swings to -22 VDC level and the collector of Q6 can then swing to -22.6 VDC. When the tube is turned on, the upper level of the blanking pulse controls the intensity. The collector of Q6 cannot swing more negative than the diode drop of CR9, and the DC level of TP2.

Thus the output of Q6 is a square pulse that is fixed at the upper level by the +30 V supply and variable at the lower level by the intensity control circuit and blanking signal. Capacitor C11, will charge to this variable AC level, through diode CR6. The cathode of CR6 is referenced to the -1000 VDC supply. When the collector of Q6 goes positive, the DC charge of C11 is added to the -1000 VDC at the cathode of CR7. Capacitor C11 will try to discharge through R4 and this establishes the DC voltage level at the control grid of the CRT. The edges of the blanking pulse signal are also coupled to the control grid through capacitor C12. This assures fast control of the tube intensity. Capacitor C11, recharges to the resulting signal change at the collector of Q6.

4-16. AC POWER SUPPLY

The AC power supply consists of a transformer with eight separate DC output voltages for suppling the necessary power to the oscilloscope circuits. The voltage regulators are internal current and thermal limiting. Three of the eight regulators require heat sinking to dissipate the excess heat and are mechanically connected to the metal side cover of the power supply case.

Each set of power supplies are fed by a center-tapped secondary winding with full wave rectification. Four of the low voltage supplies are adjustable by variable resistors. This is necessary since these power supplies feed power to the various differential amplifiers. These amplifiers have constant current sources and require fixed power supplies to assure proper dynamic ranges.

4-17. DC POWER SUPPLY

The DC power supply for the PS950 is, in effect, a substitution for the AC power supply. Both power supplies utilize the same multipin connector through which the individual DC power supply voltages are provided for the instrument. The only real difference is the manner in which these voltages are obtained.

A step-down line power transformer with two secondaries is used to provide battery charging and instrument power when operating from the line. The output of the main power secondary is rectified and filtered providing approximately 16 VDC at nominal line. This voltage provides the input to a DC regulator that supplies a low-ripple, 10 V output to the inverter circuitry. The square-wave inverter has five secondary windings, the voltages of which are rectified and filtered to provide the necessary DC for the instrument.

The battery charger circuitry derives its power from a separate secondary winding of the power transformer. The charger is of the type which provides constant current charging until the battery reaches about 13 V at which point the charger switches into a constant voltage mode to "finish" the battery to 13.5 V. A fuse is provided to protect against polarity reversal.

THEORY OF OPERATION MODEL 975

4-18. The Model 975 DMM-Counter consists of a 3.25 digit, three function digital multimeter and a four digit, 50 MHz frequency counter. The DMM section of the instrument has two separate inputs. The first, located on the front panel of the 975, features 10 Mohm input resistance on DC and AC and is also used for Kohm. The second input mode places the DMM in parallel with the scope's CH1 input behind the scope input coupling. The input to the counter comes from the scope trigger generator. Refer to block diagram, Figure 4-3 and schematic diagram 9751001.

4-19. DMM FUNCTION SELECTION AND CONTROL

Four station, interlocking push button switch, S2 controls the routing of input signals to the DMM and also provides logic signals for function selection. Each switch station consists of a four-pole, double throw switch. The discussion will treat each of four situations:

1. "SCOPE" Depressed
2. "DCV" Depressed
3. "ACV" Depressed
4. "Kohm" Depressed

4-20. "SCOPE" Button Depressed

With the SCOPE button depressed the DMM receives its input from the oscilloscope. The signal line to the DMM (a shiedled cable) is coupled through the oscilloscope's CH1 input coupling. So, if the operator depresses the "AC" coupling button on the oscilloscope CH1, the signal is AC coupled to both the oscilloscope CH1 and the DMM. Similarly, if the "DC" button on the scope is depressed, the signal is direct coupled to both instruments. Additionally when the DMM is in SCOPE mode, the oscilloscope CH1 coupling switch controls lines which program AC or DC function to the DMM. These logic lines are coupled from connector P5 to the SCOPE station of switch S2. With the SCOPE button depressed the logic signals are routed to FET switches, Q26 and Q27, which control the input to the analog processor.

4-21. "DCV" Button Depressed

With DCV depressed the DMM accepts its input from connector J301, the input connector located on the DMM front panel. Since the SCOPE button is extended, the logic lines from the oscilloscope are opened and FET switch Q27 is closed by programming from the DCV station. The shielded wire from the oscilloscope is also switched to a dummy resistor-capacitor network, R75 and C52, which simulates the impedance of the DMM input as seen by the oscilloscope. The input signal is coupled from the "AUX" input on the front panel via shielded cable through the DCV station to R76, the input resistor to the Input Buffer.

4-22. "ACV" Button Depressed

The ACV operational mode of the DMM allows the instrument to measure the RMS value of a sinusoidal input waveform. ACV mode is very similar to DCV in terms of the switching performed by S2. When the ACV button is depressed, the input signal is coupled from J301 through capacitor C16 and the ACV station of S2 to the input buffer. C16, the input coupling capacitor, blocks any DC component of the input signal so that only the AC is passed into the input buffer.

NOTE

When the DMM is operated in SCOPE mode and when AC coupling is selected on the oscilloscope, the input coupling capacitor is provided by the scope.

The ACV station of S2 also closes FET switch Q26 to select the output of the AC Converter.

4-23. "Kohm" Button Depressd

When the DMM is operated in the Kohm mode, the input is taken from the AUX input only. Kohm cannot be programmed from the oscilloscope. When the Kohm button is depressed, the ohms convertor is switched across the AUX

terminals by the Kohm station. The polarity LED, DS2, is also disconnected by the Kohm station so that a negative indication cannot be given.

4-24. INPUT BUFFER

The Input Buffer performs all necessary scaling for input signals when the DMM is operated in ACV, DCV, or SCOPE. It is configured as an operational amplifier having a fixed input resistor and switched feedback resistors to provide ranging. There are four ranges corresponding to gains of -1, -0.1, -0.01, and -0.001.

The output of the function control switch is routed to input resistor R76 which couples to the summing junction of the input buffer. Dual FET U28 and integrated circuit U29 comprise the active portion of the input buffer. U28 is employed to give high input impedance and is operated as a dual source follower with the non-signal input used to zero the amplifier output. The output of the signal-side FET couples to the inverting input of U29 yielding an inversion from input to output. The output of U29 is coupled back to the summing junction through R87. The output also goes to three other feedback networks which are switched by FET switches Q21-Q24. Each network consists of a fixed resistor in series with a reostat used for alignment. FET switch Q21 is provided for additional isolation when operating on the 2 V range. Without Q21 there is to much parasitic feedback capacitance at 5 kHz. Range information is decoded by the auto range control circuitry, level shifted by the range drivers, and applied to the proper gates of Q21-Q22. To select the 20 V range Q21 and Q22 are turned on. Similarly, Q23 and Q21 turned on selects the 200 V range and Q24 and Q21 select the 2000 V range. The input buffer is designed such that it provides ranging for both AC and DC signals.

4-25. AC CONVERTER

The output of the Input Buffer also is coupled to the AC Converter consisting of U9, U12 and associated circuitry. U9 is configured as precision rectifier so that the signal at the junction of CR15 and R99 is a positive-going, halfwave rectified sine wave. This signal is summed with the input signal through weighted resistors R102 and R101 to the summing junction of operational adder U12. The weighted summing yields a full-wave rectified current into the summing junction of U12. R106 in series with R108 sets the gain of the adder so that the average DC value at the output of the adder can be adjusted to the RMS value of the input signal. C29 serves to filter the rectified signal. R95 is provided to adjust U9's offset to zero and R103 adjusts U12's offset to zero.

4-26. OVERLOAD LIMITING AND OUTPUT SWITCHING

The output of the Input Buffer and the AC Converter are switched by FET switches Q27 and Q26, respectively, to the input of the Analog Processor. The Function Selector switch, S2, controls the switching state of Q27 and Q26. In order to ensure that Q27 and Q26 can be turned off by their drive circuits, overload limiting is employed at the output of the Input Buffer and AC Converter. Q28 and Q37 biased as emitter followers by resistive dividers provide clip levels for diodes CR20, CR26, and CR21. All the FET

switches employed in the DMM operate essentially the same way. Thus, the folowing discussion of Q27 will virtually apply to all others. If point "J" on the schematic is left open, the cathode of CR22 will tend to drop to -12 V due to R115. This will forward bias CR22, pulling down the gate of Q27. Assuming the source of Q27 to be at a relatively low impedance point that stays near 0 V, the gate will go almost to the negative supply (R114 and R115 form a voltage divider, neglecting CR22). With the gate almost 12 volts below the source, the drain-source path becomes a very high resistance. If point "J" is switched to +12 V, CR22 is reverse-biased, very little current flows through R114, and the gate-source potential is nearly zero. This causes the source-drain path to go to a low resistance, turning Q27 on.

4-27. REFERENCE

The reference for the Model 975 provides a stable voltage for the Analog Processor and the Ohms Converter. The low impedance, stable voltage is achieved by reference element CR9, integrated circuit U25, and associated circuitry. Current flows from the output of U25 through CR9 and R54 to circuit common. The voltage drop across R54 is applied to the non-inverting input of U25. The output of U25 drives positive as does the divided point of the resistive divider comprised of R56, R57 and R58. This divided voltage is fed back to the inverting input of U25. The output of U25 assumes a voltage such that both inputs to U25 are nearly equal. R57 is adjusted until the voltage across R54 is commensurate with the recommended current for CR9. Thus, the reference voltage is the sum of the reference element drop and the drop across R54.

4-28. OHMS CONVERTER

The measurement of resistance with the Model 975 utilizes a precision current source to pass a known current through the unknown resistance. The resulting voltage drop is applied to the analog processor. The current source consists of integrated circuits U26 and U27, FET Q17, FET switches Q18, Q19, and Q20, and associated circuitry. The reference voltage is divided by resistive divider R59, R60, and R61. The divided point is applied to one input of dual FET U26, operated as a dual source follower. The outputs of U26 couple to the inputs of U27. The output of U27 drives the gate of FET Q17, operated as a source follower with respect to the feedback path. The voltage on the source of Q17 is fed back to the other input of U26. Consider FET switches Q18-Q20 open for the following discussion. Q17 draws current through R64 until the voltage drop across R64 equals the drop across the top part of the resistive divider. R60 is adjusted until the current through R64 is 1 uA. Since the source current and drain are almost equal in a low leakage FET, the drain current is 1 uA for all practical purposes. The drain of Q17 couples through protection thermistor R74 and the Kohm station of the function selector switch to the front panel connector J301. The voltage thus derived at J301 is coupled back through the Kohm station to the input of the analog processor. FET switches Q18-Q20 are alternately closed to switch in other resistors to obtain different constant currents, thus providing additional Kohm ranges.

4-29. RANGE DRIVERS

The Model 975 is fully auto-ranging on DCV, ACV, and Kohm. Range information is provided by the digital processor to the range control circuitry. The range control circuit provides logic signals to the range drivers for selecting the proper range of the input buffer or the Kohm Converter. Each range driver consists of level shifting circuitry to drive FET switches. The following discussion treats the operation of one range driver. The other three function quite similarly. Consider pin 15 of U17 to be at 0 V. The 0 V level couples through R127 to the emitter of common base stage Q34 causing it to be turned off. With Q34 non-conduction no current flows into the base of Q33. Thus, Q33's collector passes no current and sets at the reference voltage provided through R70. This causes Q19 to be switched on since its gate and source are at the same potential. So, if Kohm has been selected, the 20 Kohm range is closed and the precision current source outputs 100 uA. With the collector of Q33 at the reference potential CR23 is reverse-biased causing the gate of Q22 to be a 0 V. Since the source of Q22 is also at 0 V, the 20 V range of the Input Buffer is selected. If the logic level at pin 15 of U17 is at +5 V, the above reasoning complements, resulting in the gates of Q19 and Q22 to be at -12 V causing them to be switched off.

NOTE

The "2" range output (collector of Q35) is logically inverted by Q25 resulting in Q21 being turned on for all ranges except the "2" range.

4-30. ANALOG PROCESSOR AND DIGITAL PROCESSOR

The Analog and Digital Processors are MOS integrated circuits that convert a DC input to four-digits of BCD information. The Analog Processor contains an input buffer, and integrator, and other circuitry. The conversion technique consists of a variation of a pulse-rebalance scheme in which the number of rebalance pulses are counted over an accurate time interval. The counting and accumulation of the pulses is done by the digital processor. The digital processor also puts out four-digits of BCD data which is multiplexed. The clock which feeds the digital processor is derived from the crystal oscillator. The clock frequency is chosen to achieve maximum noise rejection at multiples of 60 Hz. C33 also provides filtering for additional noise rejection.

4-31. BCD-to-SEVEN-SEGMENT DECODER

The BCD output lines from the digital processor couple directly to U20, a BCD-to-Seven-Segment Decoder. The decoder's seven outputs feed the readout integrated circuit through current setting resistors.

4-32. READOUT AND DECIMAL POINT LOGIC

The integrated circuit, LED readout, DS3, accepts decoded data from U20 and the multiplex lines from the digital processor integrated circuit, U21. The digit strobes from U21 are logically inverted by four of the inverter

gates of U15 and drive into DS3 through diodes CR32-CR35. When one of the digit strobes goes high, the corresponding multiplex line into DS3 pulls down. This enables one digit's-worth of LED segments since the cathodes of any digit's segments are tied in common. The decoded outputs of U20 light the proper segments through R150-R156. The inverted digit strobes are "nored" with information from the auto range control circuitry to obtain decimal point information. When one of the "nors" of U13 has both inputs low, it turns on one of four transistors, Q40-Q43. The collectors of Q40-Q43 are all "wire-ored" and turn on Q39 to light a decimal point through R162.

4-33. AUTO RANGE CONTROL

The Auto Range Control Logic consists of shift register U17, monostable U19, and associated circuitry. The discussion of the operation can be best understood by assuming a downrange condition and an uprange condition.

4-34. DOWNRANGE CONDITION

The Digital Processor indicates a downrange condition (less than 01000) by pulling the most significant data bit high at the time the most significant digit strobe comes high. These logical outputs are inverted and "nored" by one of the gates of U18. The "nor" output feeds the preset inputs of shift register, U17, to set all U17's outputs high. This corresponds to the lowest range of the DMM. Thus, the auto range circuitry always causes the DMM to step to its lowest range upon receipt of a downrange command. The outputs of the shift register feed directly to the range drivers.

4-35. UPRANGE CONDITION

Consider that the shift register is left in a downrange condition. This implies that outputs A, B, and C are high. The Digital Processor indicates an uprange condition by pulling all digit strobes alternately high and low. The inverted strobe lines feed a four-input "nand" whose output couples to monostable U19. When the input of U19 is pulled low, its output goes high and stays high for a time determined by R160 and C42. The input to U19 can be pulsed without affecting the output until the timing cycle is completed. The positive transition out of U19 clocks U17, causing a low state to be shifted into the first bit of the shift register. This leaves all but the A output high, corresponding to the 20's range. In the event of further uprange commands, a high level is shifted into the shift register. The delay is provided to assure adequate conversion time for the processors so that false upranging doesn't occur. When the highest range is chosen, the C output is fed to the reset line of U19 to prevent further bit shifting.

4-36. COUNTER OPERATION

The counter for the Model 975 derives its input from the oscilloscope trigger circuit. A crystal oscillator provides an accurate time gate over which the counter accumulates scope trigger pulses. All accumulating, decoding, and latching is done by a single chip, four-digit counter. Range selection and decimal point control is performed by a five-station, push button switch.

4-37. RANGE SELECTOR AND INPUT FREQUENCY DIVISION

The level-shifted trigger signal from the oscilloscope is coupled to the 975 via shielded cable. This input signal goes to the Range Selector switch, S1, a five-station, interlocking push button switch. The input is also routed to a three-decade frequency divider consisting of U1, U2, and U3 with outputs from the decade points coupled to the Range Selector switch. The following table shows the relationship between the selected range, the gate time, and the factor by which the input frequency is divided.

Table 4-1. Range Selector and Input Frequency Division

RANGE	GATE TIME	INPUT FREQUENCY DIVISION
10 kHz	1 second	none
100 kHz	.1 second	none
1000 kHz	.1 second	10
10 MHz	.1 second	100
50 MHz	.1 second	1000

4-38. CRYSTAL OSCILLATOR AND TIMING CIRCUITRY

The crystal oscillator consists of a differential amplifier stage, Q1 and Q2, with the crystal used as an element to introduce positive feedback. Q3 and Q4 serve as level shifters to "square-up" the oscillator output. The 3.2768 MHz output is applied to U23 which divides the frequency by four to yield 819.2 kHz. The output of U23 is further divided by 16,384 in U24, a 14 bit binary counter, to achieve 50 Hz at the bit 14 output. The output from bit 1, 409.6 kHz is divided by 10 to achieve a 40.96 kHz clock for the DMM, a frequency chosen to maximize 60 Hz noise rejection. The bit 14 output is also further divided by 10 in U8 to obtain 5 Hz necessary for the one-second gate interval. The 50 Hz and 5 Hz outputs are coupled to the range selector switch so that the proper gate time can be selected.

4-39. GATE GENERATION AND HOUSEKEEPING

The 50 Hz or 5 Hz signal couples from the range selector switch to decade counter U7, which further divides the signal to 5 Hz or 0.5 Hz, respectively The "low" half-period becomes the 0.1 sec or 1 sec gate which "nors" with the input frequency in U5 to create the input signal to the counter, U10. Other outputs from U7 are gated in such a way as to create two "housekeeping" signals for U10. The first housekeeping pulse, named XFR, transfers the count to the output latches for presentation to the BCD-to-Seven-Segment Decoder, U11. The other pulse, RST, resets the counter to zero. Both pulses occur during the "high" half-period after the gate is removed.

4-40. FOUR-DIGIT COUNTER

U10, the four-digit counter, can achieve a count of 9999 and has all necessary logic for multiplexing the four digits. The output is BCD formatted and is inverted before feeding to the BCD-to-Seven-Segment Decoder. A counter extend output is provided to activate the Over-Range Flasher circuit in the event of an over-range. (A second over-range condition detector is provided and will be discussed later).

4-41. BCD-to SEVEN-SEGMENT DECODER AND READOUT

The BCD output lines from the four-digit counter couple to inverter transistors, Q12-Q15, the collectors of which feed U11, a BCD-to-Seven-Segment Decoder. The decoder's seven outputs feed the readout through current setting resistors. R43-R49. The LED readout, DS1, accepts decoded data from U11 and the multiplex lines from the four-digit counter. The digit strobes are logically inverted by Q8-Q11 and drive into DS1 through diodes, CR5-CR8. When one of the digit strobes goes high, the corresponding multiplex line into DS1 pulls down, enabling one digit's worth of LED segments. U11's decoded outputs light the proper segments through R43-R49. Decimal point information is switched by S1 from the inverted digit strobes to Q16 which feeds DS1.

4-42. OVER-RANGE FLASHER

The counter readout blinks when an over-range signal is processed by the four-digit counter. This is accomplished by setting two transistor latch, Q6 and Q7, with the count extend output from U10. When the latch is set, it drives the lamp test terminal of U11 to blank the readout. The reset pulse to U10 also resets the latch to unblank the readout. Since the set and reset signals are at a 10 Hz rate, the readout will blink. An alternate way of creating a blinking readout is also included. If the input frequency is too high for the four-digit counter to process (a situation created by the input of a very high frequency when the counter is locked on a low range), no count extend is issued. To cover this situation, a two-bit counter, U4, is employed. A 9.76 usec gate from the bit four output of U8 is used to detect frequencies above 100 kHz. When the two-bit counter finds a frequency above 100 kHz, it sets the flash latch instead of the count extend from U10. The latch is reset the normal way.

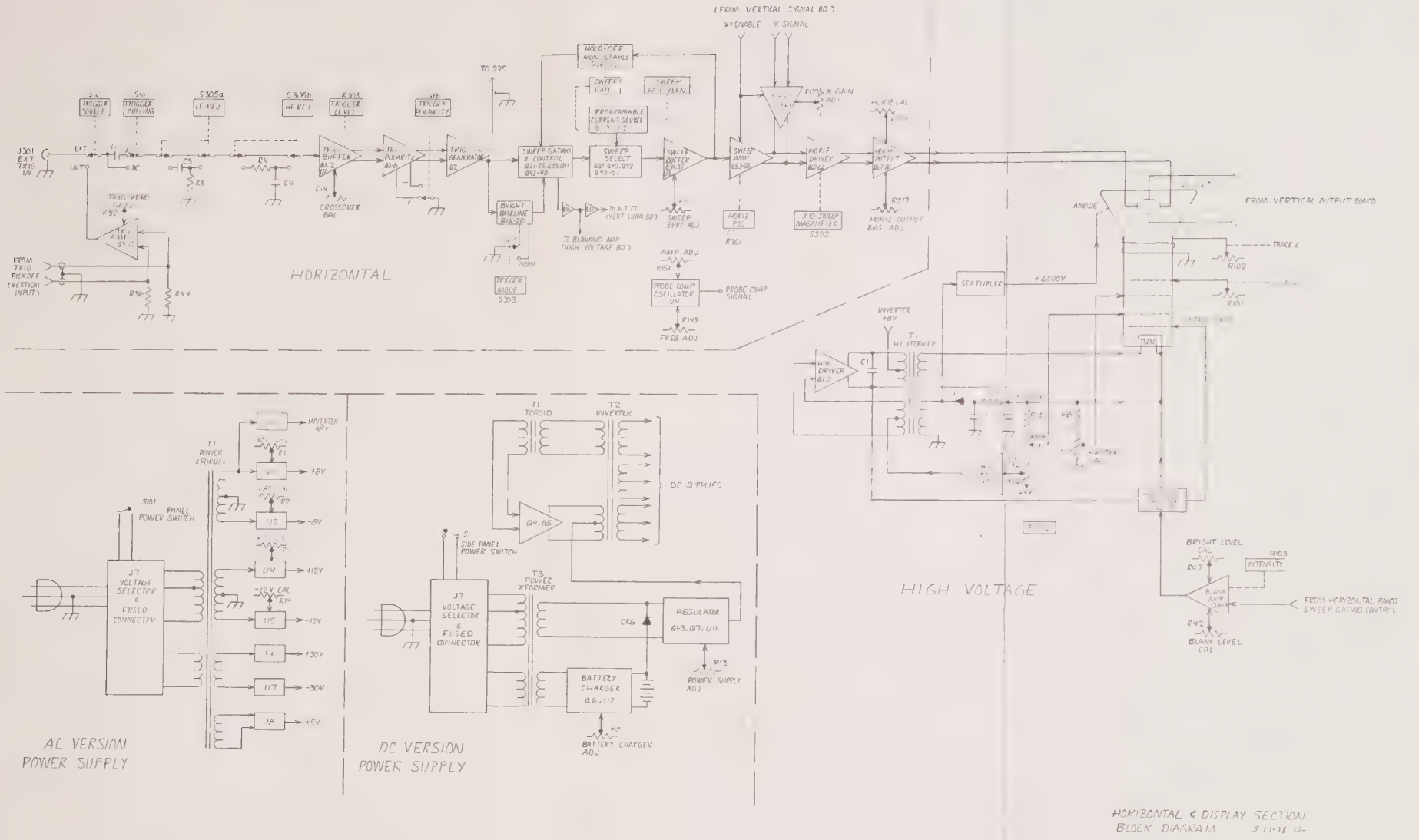

Figure 4-1. Block Diagram Model PS950 Horizontal & Display Section

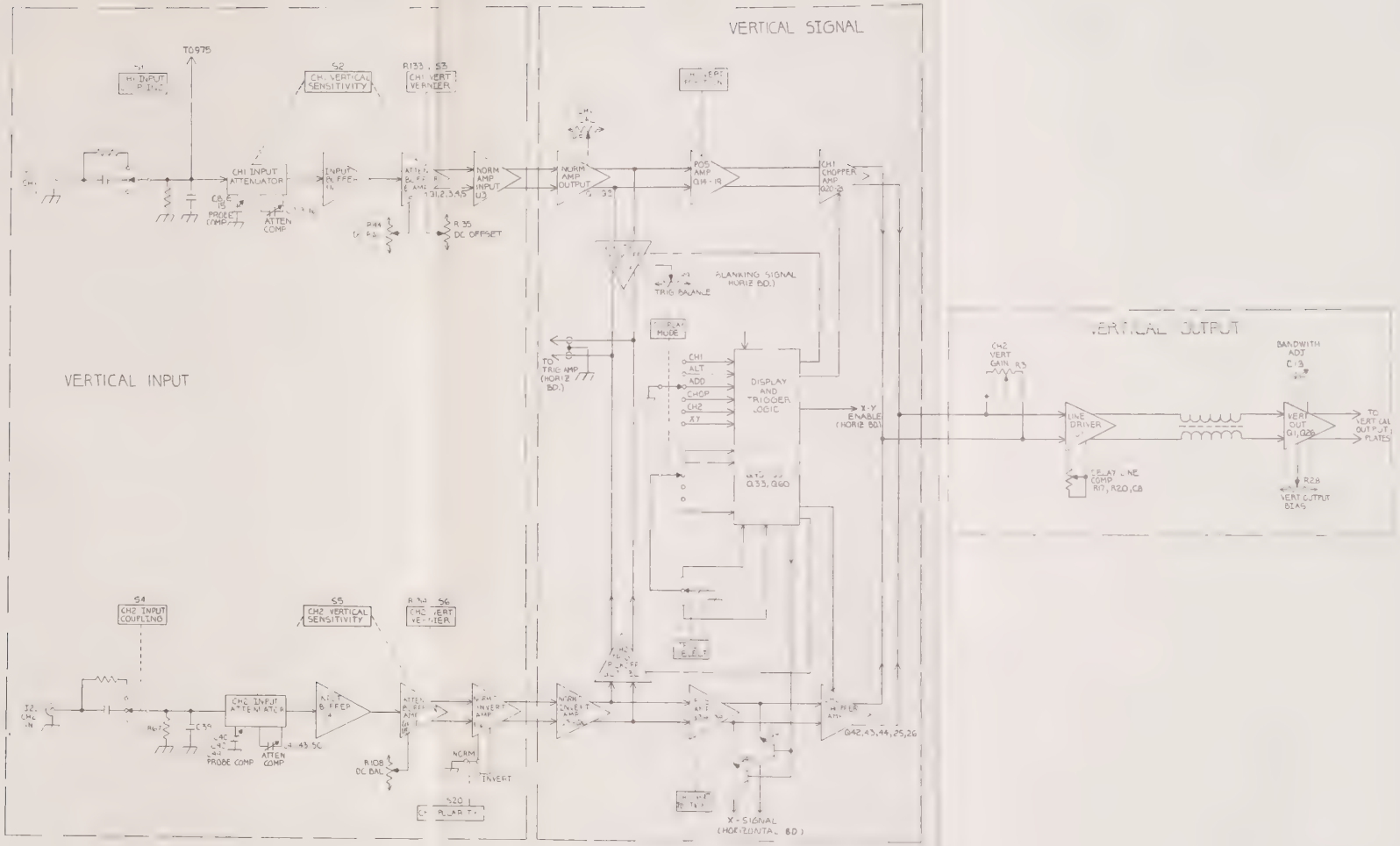

Figure 4-2. Block Diagram Model PS950 Vertical Section

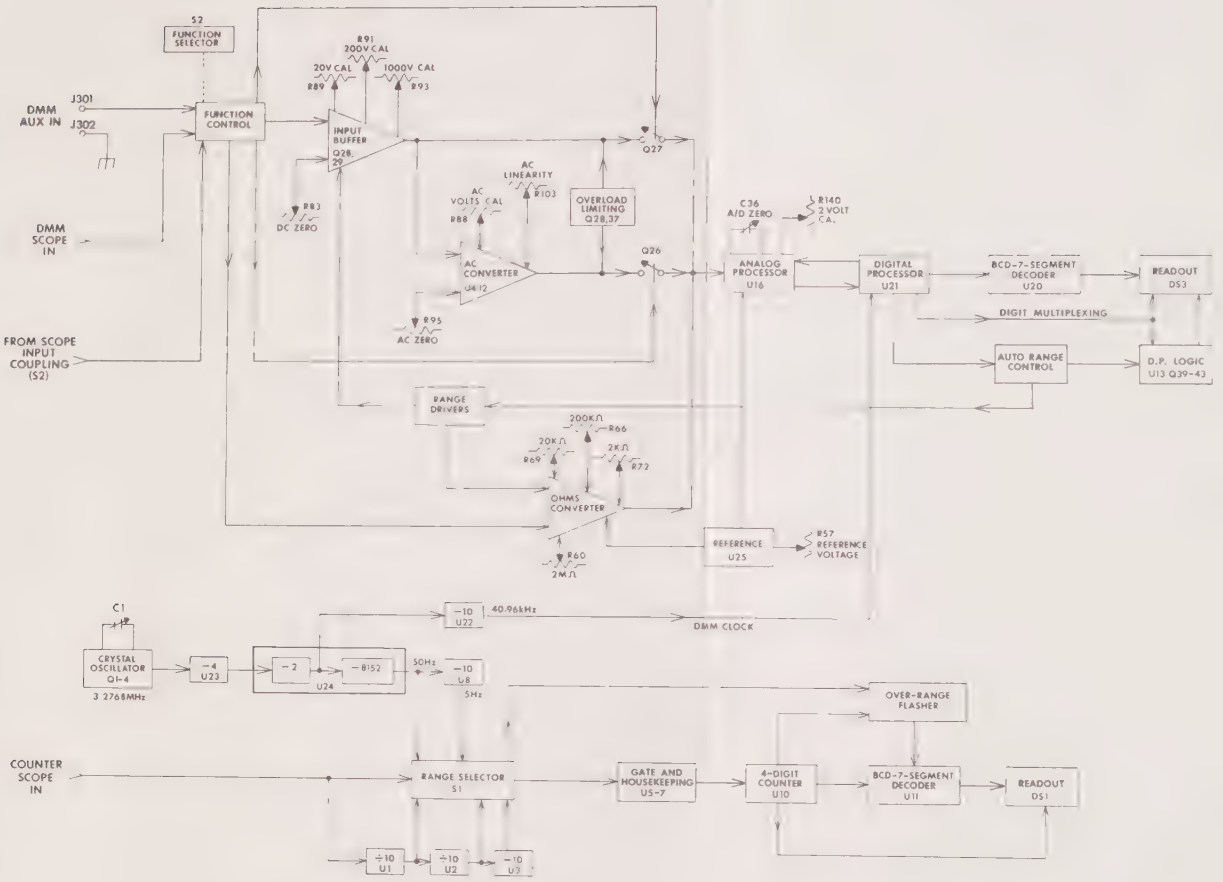

Figure 4-3. Block Diagram Model 975

SECTION V

MAINTENANCE

SECTION V

5-1. GENERAL

This section of the manual contains the information necessary for preventive maintenance, troubleshooting, corrective maintenance and calibration of the PS950 Oscilloscope, and the Model 975 DMM-Counter.

5-2. PREVENTIVE MAINTENANCE

Preventive maintenance consists of periodic cleaning, inspecting, tightening, and recalibrating the instrument at a regular interval. This will keep the instrument in its best operational and appearance condition.

5-3. Cleaning

CAUTION

> Avoid the use of chemical cleaning agents such as MEK, laquer thinner, or strong acids or alkali. These solvents will cause paint removal, deterioation of switches and the melting of plastic parts.

Accumulation of dirt or dust should be removed when they become noticable. The frequency of cleaning will depend on the environment in which it is used. Loose dust on the outside may be removed with a soft cloth or a dry brush. A diluted household cleaning solution can be used but avoid the use of an abrasive cleaner. Fingerprints on the cathode ray tube (CRT) should be removed with lens cleaning tissue. Cleaning the inside of the unit should be done with low pressure air or a soft brush. Cleaning the inside of the oscilloscope should preceed the calibration, since the cleaning procedure could alter the settings of the adjustments.

CAUTION

> Whenever the covers are removed from the instrument, make sure that the instrument is disconnected from the AC power line and the battery pack is removed. The interior of the instrument contains high voltage circuits which could be hazardous to your health if the instrument power switch was accidentally turned on during maintenance, with a power source connected.

5-4. Inspection

After cleaning the instrument, a thorough inspection of the components on the circuit boards can reveal areas where troubles could occur. Look for the obvious things like components with discolored markings from overheating.

Check the wiring in areas where chafing may have become a problem. Removal of the circuit boards is not recommended unless part replacement is required.

5-5. TROUBLESHOOTING

Most of the problems resulting in a malfunction will be a defective electronic component or a defective mechanical problem. Verify that the problem is not due to an incorrect switch setting (refer to section III for the operational functions of the controls). The CRT display can be a valuable aid in isolating a malfunction. The loss of any of the amplifier, (vertical or horizontal) trigger circuit, (internal or external) or blanking circuit will be noticable on the CRT display.

Standard test equipment can be used to isolate a malfunction down to a component. The use of the operational procedure (see section III) will verify the operation of the various sections and controls. Section IV contains the overall block diagram of the PS950 Oscilloscope and the Model 975 DMM-COUNTER.

Section VII contains the schematics for the PS950 Oscilloscope as well as the two schematics for the Model 975 DMM-COUNTER. A thorough understanding of the theory of operation will be a valuable aid in troubleshooting.

5-6. Troubleshooting Precaution

WARNING

Before removing the covers for troubleshooting, read and observe the following precautions given below. This instrument contains a CRT with an implosion hazard. Several high voltage power supplies are located underneath the display assembly which could become hazardous if not handled properly.

1. Always remove the line cord from the instrument when removing or replacing the top and bottom covers.

2. Wear "safety" goggles with side shields when handling the CRT to prevent possible injury from flying glass in case of tube breakage

3. When removing the tube from the shield, be very careful of the tube tip located in the center of the CRT socket. Do not strike or scratch the CRT and never subject the CRT to more than moderate pressure when installing in, or removing from the instrument.

4. Avoid shorting of the low voltage power supplies and the -1000 VCD supply on the High Voltage board and CRT socket.

5. Before working on the High Voltage board, place a jumper from ground to the insulated stand-off (anode connection). This will discharge all of the high voltage circuits.

6. Do not unplug any of the circuit boards with power applied to the instrument.

5-7. PARTS IDENTIFICATION

The Model PS950 Oscilloscope naturally divides into five (5) parts or "modules". These modules are as follows.

1. Vertical Input Assy
2. Vertical Signal Assy
3. Horizontal Assy
4. Power Supply Assy
5. Main Chassis Assy

These modules are comprised of various assemblies and sub-assemblies which are tabulated in Table 6-1.

In addition there are two parts lists which pertain to the Model 975 DMM-Counter. These parts lists, DMM-Counter Sub-Assy and DMM-Counter Chassis Assy, are tabulated in Table 6-2.

Each part is identified by a drawing reference designator, manufacturers part number, description of part, manufacturer, and Vu-data part number. When ordering parts from Vu-data, be sure to include the Vu-data part number for ease of identification. Part location drawings are available at the end of Section V.

5-8. Corrective Parts

Individual components are generally "off-the-shelf" and are available at local suppliers or may be ordered from Vu-data Corp. If other parts are substituted, make sure that the part is a direct replacement, or performance and calibration difficulties may arise.

5-9. MODEL PS950 CALIBRATION

The following procedure provides the necessary information for technical personnel to calibrate the Model PS950 Oscilloscope. This calibration should be performed at periodic intervals to certify that the equipment is operating properly. The calibration procedure is divided into nine sections. Each section may be calibrated individually without affecting the other sections. Only the power supply calibration will affect the other sections and this should be done first.

The procedure for calibration of the Model 975 DMM-COUNTER is listed separately. Refer to paragraph 5-21 for the calibration procedure.

WARNING

When performing the instrument calibration, the top and bottom covers must be removed. Extremely high voltages are exposed at the CRT socket and on the HV board underneath the CRT display. Use extreme care when moving the instrument during calibration. The power should be off and the line cord disconnected when removing or installing the covers. Screwdrivers with insulated shafts should be used to make the adjustments.

5-10. TEST EQUIPMENT REQUIRED

The following test equipment will be required to calibrate the oscilloscope. The model number and manufacturer of the equipment may be substituted provided that the specifications of the substituted unit are equivalent to the listed equipment.

1. Function Generator	H-P Model 3310A
2. Frequency Counter	H-P Model 5325A
3. Digital Volt Meter (DVM)	Data Tech Model 30
4. Constant Amplitude Generator	TEK Model 191
5. Pulse Generator	TEK Model PG 501
6. Vertical Oscilloscope Calibrator	TEK Model PG 506
7. Oscilloscope	TEK 7600
8. Time Mark Generator	TEK Model TG 501

NOTE

When calibrating a Model PS950 Oscilloscope with a Model 975 DMM-Counter, the Model 975 should not be used as a calibrating instrument. The two units share a common power supply and the adjustment of the power supply may affect the calibration accuracy of the Model 975 DMM-Counter.

5-11. LOCATION OF CONTROLS FOR ALIGNMENT

Fig. 5-1 shows the location of all the front panel controls. Fig. 5-2 shows the location of the power supply voltages on the Vertical Output and Vertical Interconnect and the adjustments on the Power Supply assembly. Fig. 5-3 shows the adjustments and test points for the High Voltage board, located underneath the CRT Display. Fig.5-4 shows the adjustments for the adjustments for the Vertical Input board. Fig. 5-6 shows the adjustments for the Vertical Signal board. Fig. 5-7 shows the adjustments and test point for the Horizontal board.

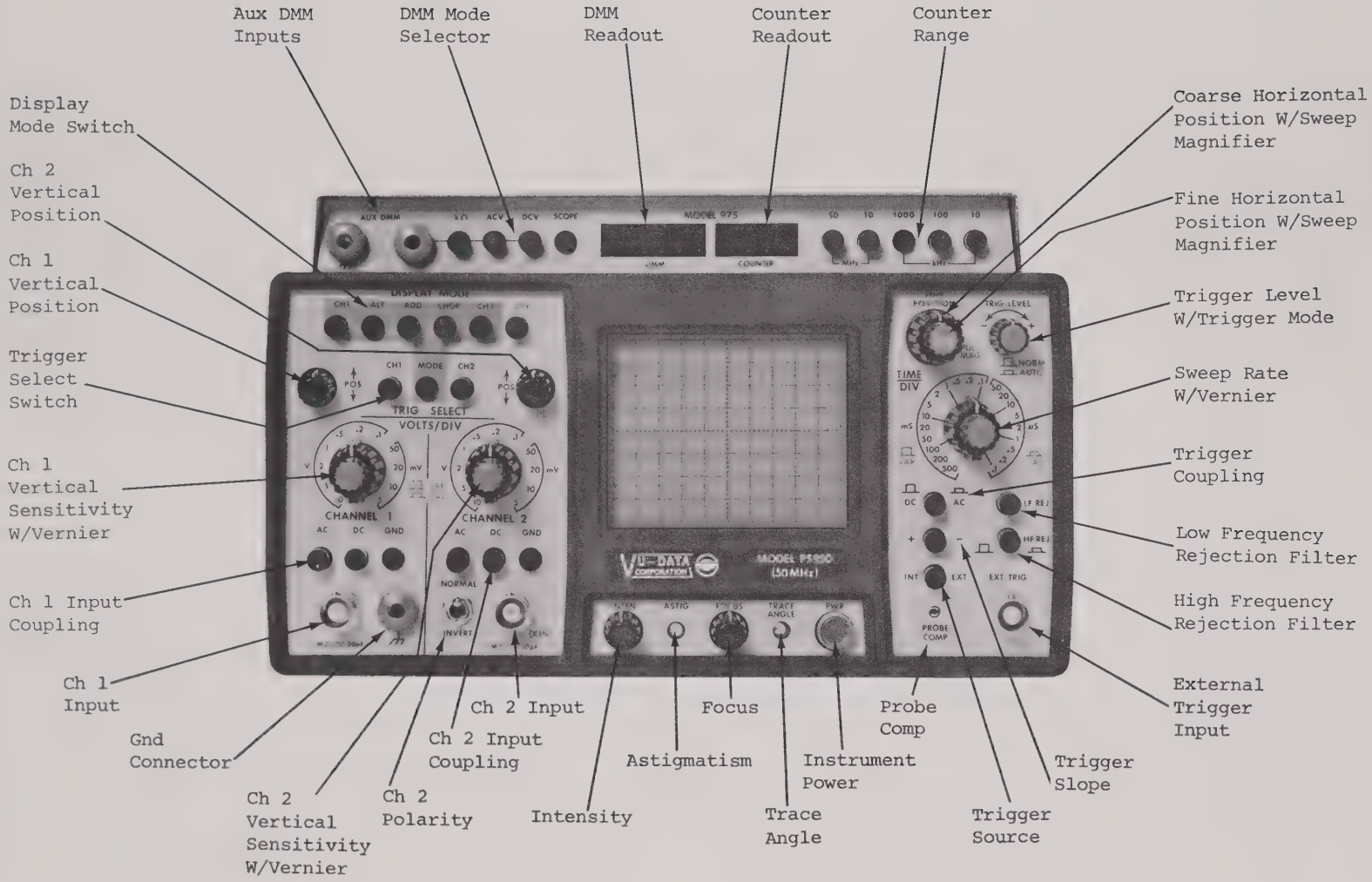

Figure 5-1. Location of Front Panel operating controls Model PS950/975

5-12. PRELIMINARY CONTROL SETTINGS

Remove the battery pack and the AC line cord. Remove the top and bottom covers. Remove the four rubber feet and the cover on the rear of the instrument. Plug in the line cord and turn the instrument on, allow 10 minutes warm-up before starting the calibration procedure.

Set the Front Panel controls as follows:

1. AC-DC-GND	CHANNEL 1-GND, CHANNEL 2-GND
2. VOLTS/DIV	CHANNEL 1-20 mV/DIV, CHANNEL 2-20 mV/DIV
3. Vertical Vernier	CHANNEL 1-Pushed in, CHANNEL 2-Pushed in
4. Vertical Position	CHANNEL 1-Midrange, CHANNEL 2-Midrange
5. NORMAL-INVERT	NORMAL
6. DISPLAY MODE	X-Y
7. TRIG SELECT	CH 1
8. Trigger Source	INT
9. Trigger Slope	+
10. Trigger Coupling	DC
11. LF REJ	Out
12. HF REJ	Out
13. TIME/DIV	1 mS
14. Horizontal Vernier	Pushed in
15. Coarse Horizontal Position	Midrange
16. Fine Horizontal Position	Midrange
17. X10	Pushed in
18. TRIG LEVEL	Midrange
19. NORM-AUTO	Pushed in
20. INTEN	Fully Counterclockwise
21. FOCUS	Fully Clockwise

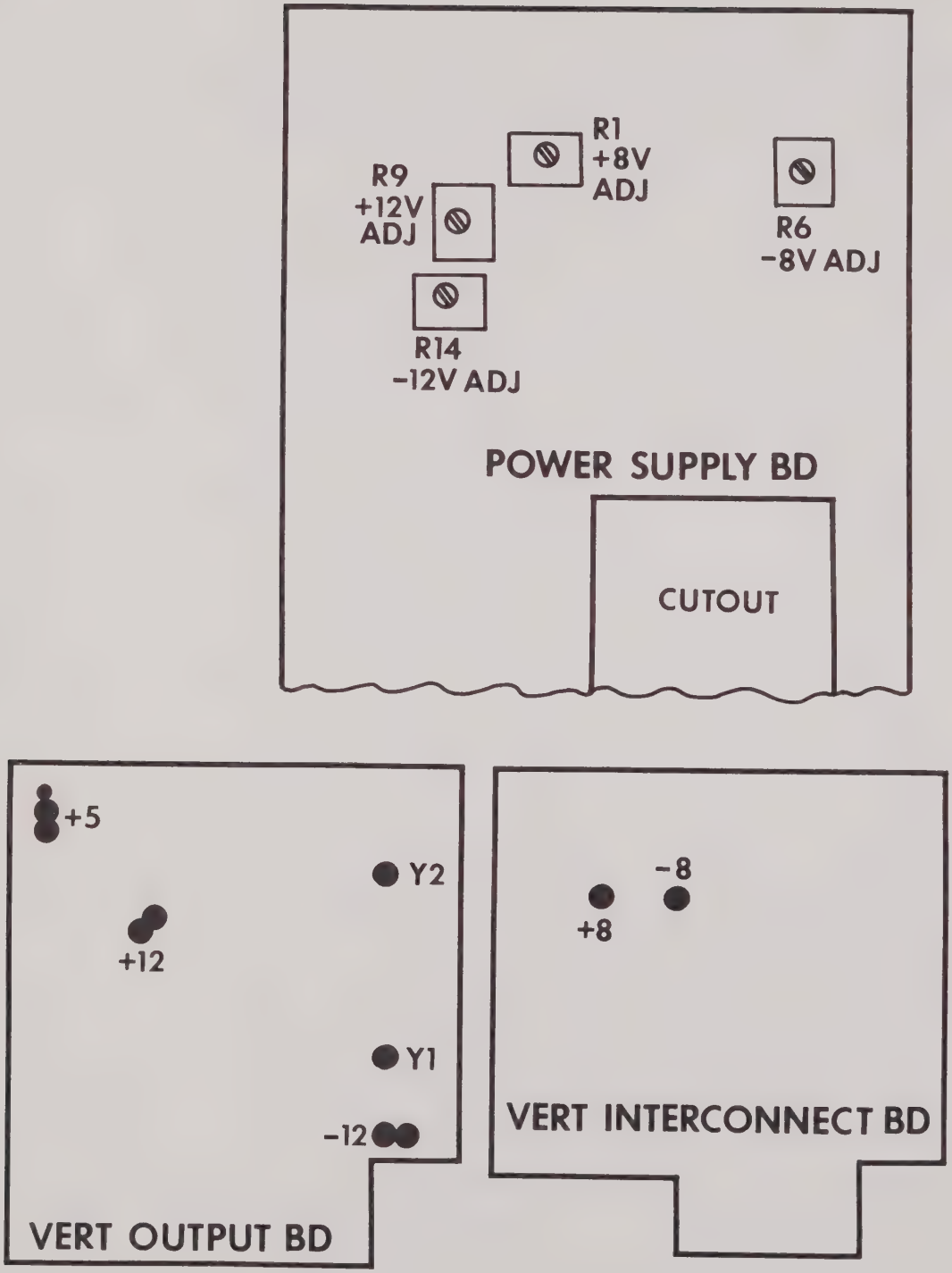

Figure 5-2. Power Supply board adjustments with Vertical Output and Vertical Interconnect board etch.

5-13. POWER SUPPLY CALIBRATION

Ref: Figure 5-2.

* For battery pack version (Option PS9310) go directly to step h below.

a. Connect the DVM low lead to chassis ground, (the chassis ground tip jack, on the Vertical Front Panel, is a convenient place to pick up chassis ground). Probe the +8 V etch on the Vertical Interconnect board with the DVM high lead. On the Power Supply board, adjust R1 for +8.00 VDC ± 0.08 VDC.

b. On the Vertical Interconnect board, probe the -8 V etch with the DVM red lead. On the Power Supply board, adjust R6 for -8.00 VDC ± 0.08 VDC.

c. On the Vertical Output board, probe the +12 V etch with the DVM red lead. On the Power Supply board, adjust R9 for +12.00 VDC ± 0.12 VDC.

d. On the Vertical Output board, probe the -12 V etch with the DVM red lead. On the Power Supply board, adjust R14 for -12.00 VDC ± 0.12 VDC.

e. On the Vertical Output board, move the DVM red lead to the +5 V etch. The digital display should be +5.00 VDC ± 0.2 VDC. There is no adjustment for this regulator.

f. Move the DVM red lead to the power supply end of R203 (+30 V) located on the Horizontal board. The DVM should read +30.00 VDC ± 1.5 VDC. There is no adjustment for this regulator.

g. Move the DVM red lead to the power supply end of R211 (-30 V) located on the Horizontal board. The DVM should read -30.00 VDC ± 1.5 VDC. There is no adjustment for this regulator.

*h. For the battery pack version (Option PS9310) delete steps a through g above. Refer to Figure 5-17, Battery Pack Assembly Drawing #9355019 for parts location. Connect the DVM low lead to chassis ground and probe the +8 V etch on the Vertical Interconnect board with the DVM high lead. Adjust R13 on the Battery Pack Power Supply board for +8.00 VDC ± 0.08 VDC.

*i. Connect the DVM to the mini-banana jacks on the bottom of the instrument (without the battery plugged in). Adjust R8 on the Battery Pack Power Supply board for 13.5 VDC ± 0.05 VDC.

WARNING

The following calibration section pertains to the High Voltage board. This circuit contains the +6000 VDC post acceleration power supply as well as other high voltage circuits. Extreme caution must be used while making any adjustments on this board. The post acceleration supply should be shorted to ground if any repairs are to be made. If the -1000 VDC supply is shorted to ground, severe damage may result to the CRT intensity control amplifier.

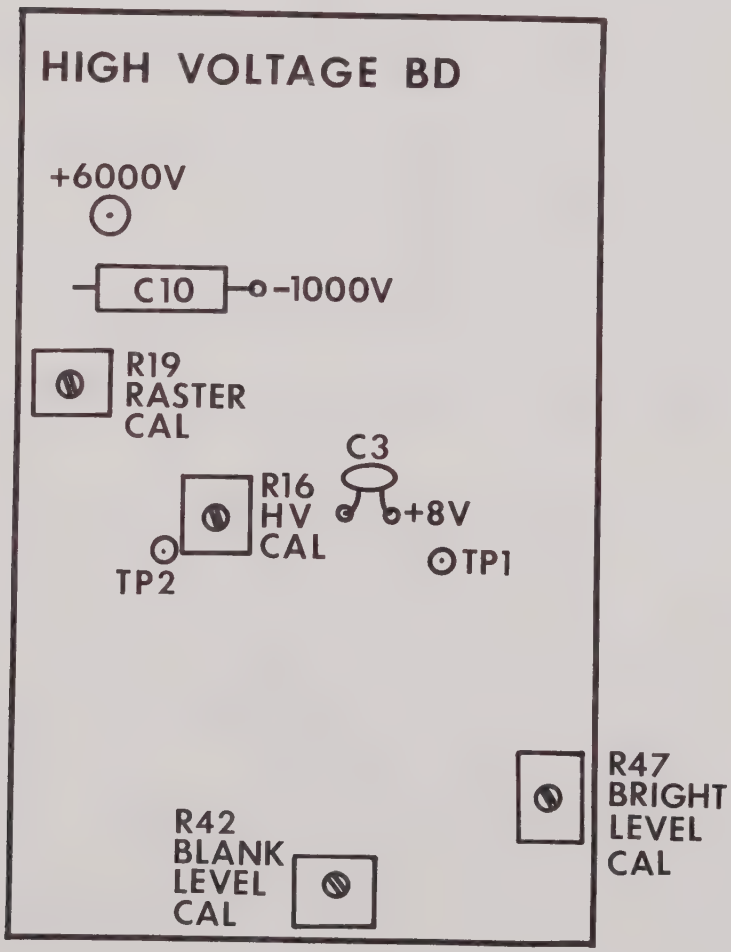

Figure 5-3. High Voltage board Adjustment Locations

5-14. HIGH VOLTAGE BOARD CALIBRATION
Ref: Figure 5-3.

a. Connect the positive lead of the DVM to the positive end of C3 and connect the negative lead to chassis ground. The DVM should read +8.00 VDC ± 0.4 VDC. There is no adjustment for this power supply regulator.

b. Connect the DVM high lead to TP2. Adjust R42 for -27 VDC. This is the "blank level" adjustment and ensures that the tube is completely blanked when the Intensity control is fully counterclockwise. Rotate the Intensity control full clockwise to observe a defocused spot on the CRT face (make sure that the FOCUS control is fully clockwise to ensure no phosphor damage). Adjust R47, the "bright level" adjustment, for +12 VDC at TP1. Return the Intensity control to the fully counterclockwise position.

NOTE

Do not leave the Intensity control in the maximum intensity position for an extended period of time. The phosphor on the CRT screen will burn if left with the intensity at maximum.

c. Turn off power to the instrument, short the post acceleration supply to chassis ground and connect the DVM high lead to the -1000 V end of C10. Remove short from post acceleration supply, restore power to the instrument and adjust the H.V. Cal adjustment, R16, for -1000 VDC. Rotate the Intensity control fully clockwise and note that the -1000 VDC supply drops in absolute value. If this change is less than 10 VDC, no further adjustment of the "bright level" is necessary. If the -1000 VDC supply change is more than 10 VDC, re-adjust R47 so that the -1000 VDC supply is -990 VDC. Rotate the Intensity control from "stop-to-stop" a few times to verify that the -1000 VDC supply changes 10 VDC or less as the beam is taken from "bright-to-dark". Depress the CH 1 position of the Display Mode switch. Adjust the Intensity, Focus, and Positioning controls from a horizontal line of normal viewing quality. Turn off power to the instrument, short the post acceleration supply to chassis ground, and disconnect the DVM.

d. Adjust the Trace Angle control until the horizontal line is parallel with the graticule lines. Connect a 20 kHz sine wave to the CH 1 BNC connector and depress the DC button on the Input Coupling switch. Adjust the Signal Generator for a full scale display. On the H.V. board, adjust Raster Cal control, R19, until the peaks of the sine wave are parallel with the top and bottom of the graticule display.

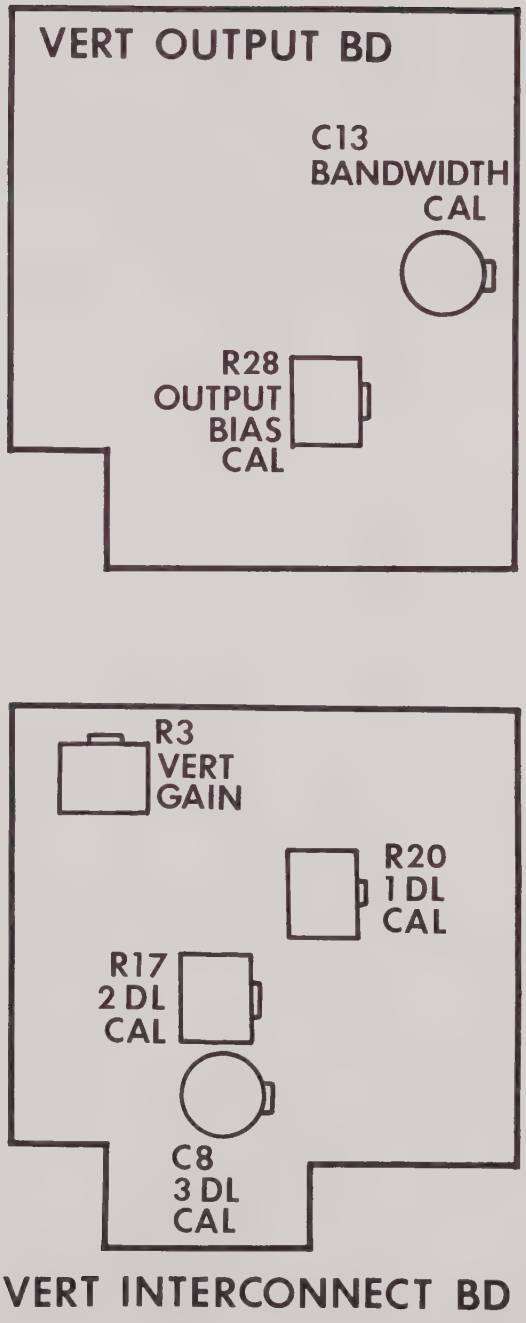

Figure 5-4. Vertical Output board and Vertical Interconnect board Adjustment Locations

5-15. VERTICAL DELAY LINE CALIBRATION
Ref: Figure 5-4.

a. Depress the GND button on the Ch 1 Input Coupling switch and disconnect the 20 kHz sine wave from the Ch 1 Input BNC. Connect the low terminal of the DVM to a convenient ground. Alternately probe Y1 and Y2 (located on the Vertical Output board) with the high lead of the DVM and use the Ch 1 Vertical Position control to equalize Y1 and Y2 to within 0.1 VDC. Adjust R28, the Output Bias Cal, to bring Y1 and Y2 to +0.0 VDC VDC ± .1 V.

b. Select the DC position of the Ch 2 Input Coupling switch, the CH 2 position of the Display Mode switch, the Mode position of the Trigger Select switch, the 10 mV/DIV position of the Ch 2 Vertical Sensitivity switch, and the .1 us position of the Sweep Rate switch. Connect the Pulse Generator to the CH 2 input using a X10 in-line attenuator, a 50 ohm coaxial cable and a 50 ohm load. Adjust the amplitude for a 6 division display. Set the Pulse Generator for a pulse width of .2 us and a period of .9 us. Adjust TRIG LEVEL control as necessary for a stable display.

c. On the Vertical Interconnect board, adjust 1 DL CAL control, R20, for a flat square pulse response.

d. On the Vertical Interconnect board, adjust 2 DL CAL control, R17, for a flat square pulse response.

e. On the Vertical Interconnect board, adjust 3 DL CAL control, C8, for a flat square pulse response with no overshoot or undershoot on the leading edge.

f. Disconnect the Pulse Generator from the Ch 2 Input, select the 5 mV/DIV position of the Ch 2 Vertical Sensitivity switch, and connect the Constant Amplitude Generator to the Ch 2 Input. Set the generator output to obtain an 8 division display @ 50 kHz. Without changing the amplitude adjustment on the generator, set the output frequency of the generator to 50 MHz.

g. On the Vertical Output board, adjust the Bandwidth CAL control, C13, to obtain slightly over 28 minor divisions of display.

h. The adjustments using C8, on the Vertical Interconnect board and C13, on the Vertical Output board, will affect both the pulse response and the bandwidth of the Vertical Output stage. It might become necessary to re-adjust these adjustments to maintain a reasonable pulse response while maintaining the 50 MHz bandwidth specification for this range of the attenuator.

NOTE

The calibration of the delay line is necessary to compensate for losses in the delay line while maintaining an actual reproduction of the Pulse Generator output. For this purpose, it might be convenient to check the output of the Pulse Generator, at the output level at which it is being used, on a high quality lab scope. This can be compared to the display obtained on the PS950 with minor variations.

5-16. VERTICAL INPUT CALIBRATION
Ref: Figure 5-5.

a. Set the controls of the PS950 Oscilloscope in accordance with paragraph 5-12. Select the CH 1 position of the Display Mode switch and adjust the INTEN & FOCUS controls for a horizontal line with desired viewing characteristics.

b. Rotate the CH 1 Vertical Sensitivity switch from the 20 mV/DIV position and alternately select the 10 mV/DIV range and the 5 mV/DIV range to note the amount of DC shift in the vertical direction. On the Vertical Input board, adjust the CH 1 DC BAL control, R44, to reduce any DC shift to less than 1/2 minor division.

c. Connect the DVM low side to a convenient ground and alternately probe pins 3 and 5 of U2. Using the Ch 1 DC offset adjustment, R135, make these points equal to each other ±0.001.

d. Select the CH 2 on the Display Mode switch. Rotate the CH 2 Vertical Sensitivity switch from the 20 mV/DIV position and alternately select the 10 mV/DIV range and the 5 mV/DIV range to note the amount of DC shift in the vertical direction. On the Vertical Input board, adjust the CH 2 DC BAL control, R108, to reduce any DC shift to less than 1/2 minor division.

e. Connect the DVM low side to a convenient ground and alternately probe pins 3 and 5 of U5. Using the Ch 2 DC offset adjustment, R136, make these points equal to each other ±0.001.

f. Connect the X10 probe to CH 1 Input and depress the DC button on the Input Coupling switch. Connect the tip of the X10 probe to the output of the Vertical Oscilloscope Calibrator, connecting the ground clip to a convenient ground.

g. If the Model 975 DMM-Counter is included, depress the SCOPE button on the DMM Mode Selector switch.

h. Set the Calibrator to .5 V p-p and connect to the X10 probe. Select the DC position of the Ch 1 Input Coupling switch and the 10 mV/DIV position of the Ch 1 Vertical Sensitivity switch. Adjust the Trigger Level and Ch 1 Vertical Position controls for a syncronized, appropriately positioned display. Adjust the X10 probe compensation for the best square wave response.

i. Set the Calibrator to 5 V p-p and select the .1 V/DIV position of the Ch 1 Vertical Sensitivity switch. Alternately adjust capacitors C15 or C16 for the best square wave response.

j. Set the Calibrator to 50 V p-p and select the 1 V/DIV position of the Ch 1 Vertical Sensitivity switch. Alternately adjust capacitors C8 and C9 for the best square wave response.

k. Set the Calibrator to 100 V p-p and select the 5 V/DIV position of the Ch 1 Vertical Sensitivity switch. Alternately adjust capacitors C6 and C7 for the best square wave response.

NOTE

Steps l and m apply only if the Model 975 DMM-Counter is included. Disregard these these steps if the DMM-Counter is not installed.

l. Reduce the Calibrator output to .5 V p-p. Select the 10 mV/DIV position of the Vertical Sensitivity switch.

m. Note the square wave response obtained for this setting. Depress the DCV button on the DMM Mode Selector switch. On the 975 DMM-Counter, adjust capacitor C52, until the display in the DCV position is the same as in the SCOPE position. Refer to Fig. 5-8 to locate this adjustment.

n. Transfer the X10 probe to the Ch 2 Input BNC, select CH 2 on the Display Mode switch, CH 2 on the Trigger Select switch, DC on the Ch 2 Input Coupling switch, and the 10 mV/DIV position of the Ch 2 Vertical Sensitivity switch. Adjust the Trigger Level and the Ch 2 Vertical Position controls for a syncronized, appropriately positioned display. Set the Calibrator to .5 V p-p and adjust C39 for the best square wave display.

o. Set the Calibrator to 5 V p-p and select the .1 V/DIV position of the Ch 2 Vertical Sensitivity switch. Alternately adjust capacitors C49 and C50 for the best square wave response.

p. Set the Calibrator to 50 V p-p and select the 1 V/DIV position of the Ch 2 Vertical Sensitivity switch. Alternately adjust capacitors C40 and C42 for best square wave display.

q. Set the Calibrator to 100 V p-p and select the 5 V/DIV position of the Ch 2 Vertical Sensitivity switch. Alternately adjust capacitors C41 and C43 for best square wave response.

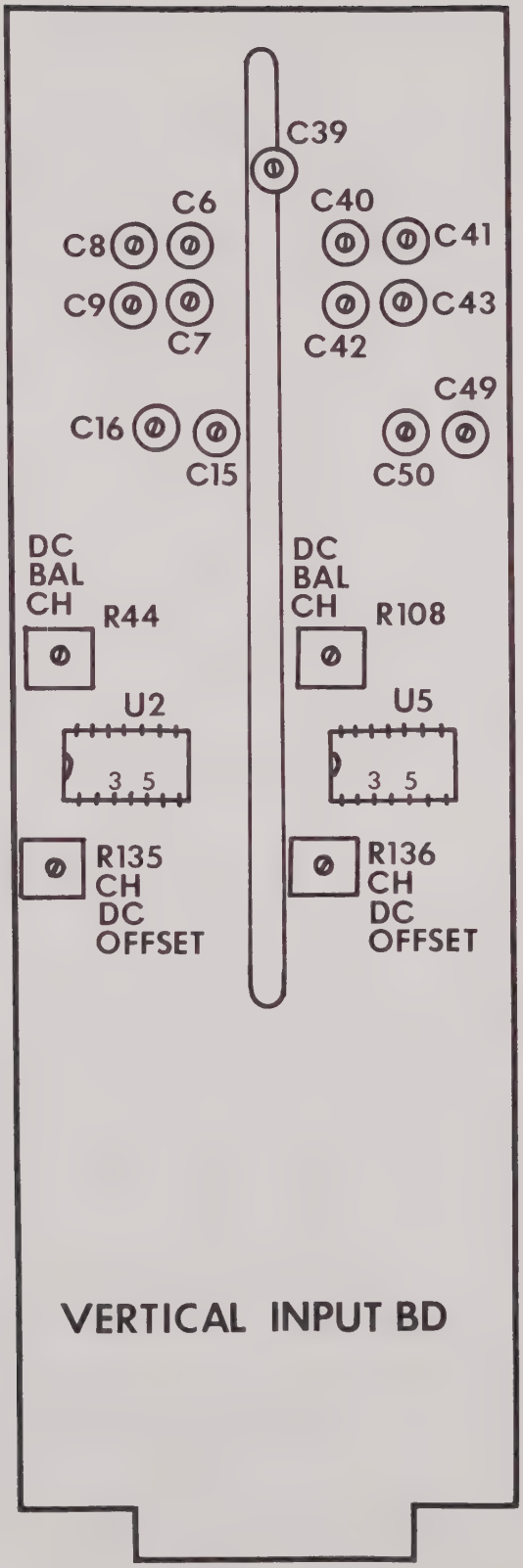

Figure 5-5. Vertical Input board Adjustment Locations

5-17. VERTICAL GAIN CALIBRATION
Ref: Figure 5-6.

a. Set the Calibrator to 20 mV and select the 5 mV/DIV position of the Ch 2 Vertical Sensitivity switch.

b. On the Vertical Interconnect board, adjust the Vert Gain adjustment, R3, for a four division display. Rotate the Vertical Sensitivity switch through its 11 ranges and verify the accuracy of all ranges. Re-adjust, if necessary to maintain the 3% accuracy specification on all ranges.

c. Switch the Calibrator from the Ch 2 Input to the Ch 1 Input. Select the DC position on the Ch 1 Input Coupling switch, the CH 1 position on the Display Mode switch, the CH 1 position on the Trigger Select switch, and the 5 mV/DIV position of the Ch 1 Vertical Sensitivity switch.

d. Set the Calibrator to 20 mV p-p output. On the Vertical Signal board, adjust CH 1 Cal, R5 for exactly a four division display. Rotate the Vertical Sensitivity switch through its 11 ranges and verify the accuracy of all ranges. Re-adjust, if necessary to maintain the 3% accuracy specification on all ranges.

5-18. TRIGGER SIGNAL CALIBRATION
Ref: Figure 5-6 & Figure 5-7.

a. Short together TP1 and TP2 on the Vertical Signal board. Depress the MODE button on the Trigger Select switch and the GND position of the Ch 1 Input Coupling switch.

b. On the Horizontal board, locate the INT-EXT switch. Note that the pin closest to the front panel and closest to the bottom of the machine has been left long. Connect the high lead of the DVM to this pin. Connect the low lead to a convenient ground. On the Horizontal board, adjust Trig Zero adjustment, R52, for a digital display of 0.00 VDC ± 0.01 VDC.

c. Leaving the DVM connected, remove the short from TP1 and TP2 on the Vertical Signal board and adjust Ch 1 Trig Bal adjustment, R9 on the Vertical Signal board, for a digital display of 0.00 VDC ± 0.01 VDC.

d. Depress the CH 2 button on the Display Mode switch and the GND position of the Ch 2 Input Coupling switch. Adjust Ch 2 Trig Bal adjustment, R84 on the Vertical Signal board, for a digital display of 0.00 VDC ± 0.01 VDC. Disconnect the DVM.

e. Connect the Function Generator to the Ch 1 Vertical Input. Set the Function Generator for a sine wave output at approximately 1 kHz. Select the DC position of the Ch 1 Input Coupling switch and the CH 1 position of the Display Mode switch. Rotate the Vertical Sensitivity switch to the 1 V/DIV range. Adjust the output of the Function Generator for a full scale display.

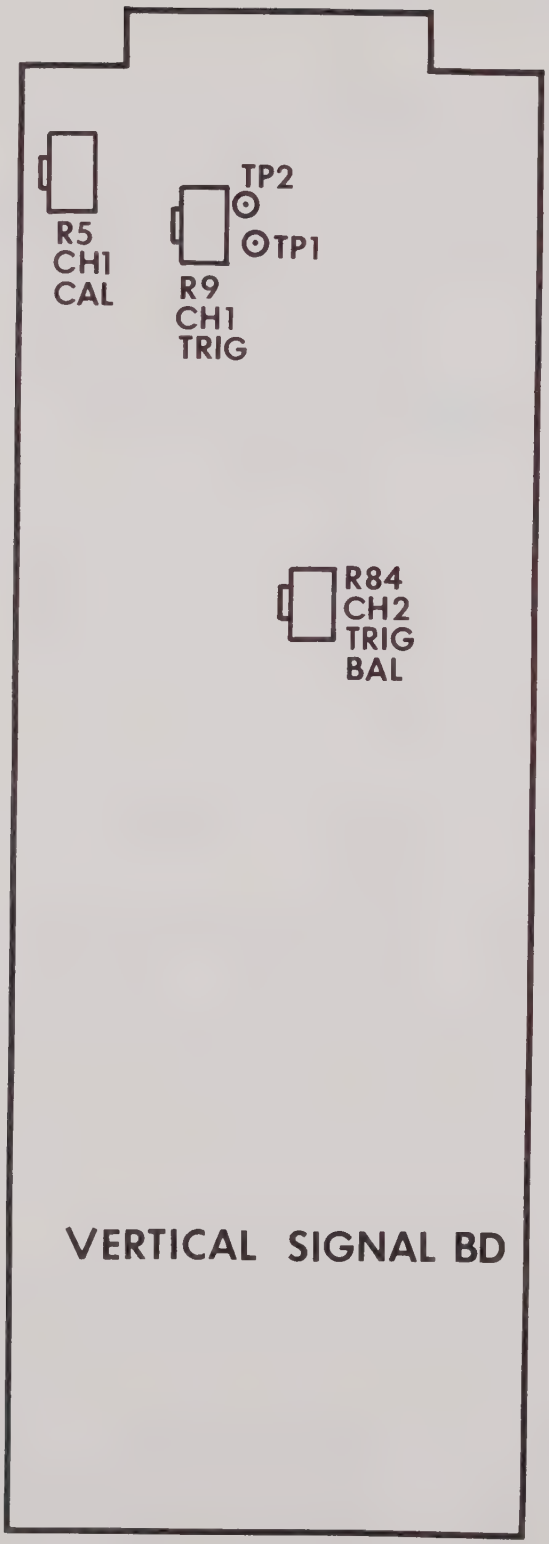

Figure 5-6. Vertical Signal board Adjustment Locations

f. Short the arm of the Trigger Level control, R303, to ground and adjust the Crossover Bal adjustment, R14, (located on the Horizontal board) so that the trace starts slightly above the centerline of the graticule.

g. Depress the Trigger slope (-) button on the Horizontal Front Panel. Re-adjust, if necessary, the Crossover Bal adjustment R14, so that the trace starts in the same place above and below the centerline, when switching between plus (+) and minus (-). Remove the short on the arm of the Trigger Level control.

5-19. HORIZONTAL CALIBRATION
Ref: Figure 5-7.

a. Select the X-Y position of the Display Mode switch and connect the low terminal of the DVM to a convenient ground. Alternately probe the X1 and X2 standoffs on the Horizontal board with the DVM high lead and use the Ch 2 Vertical Position control to equalize the voltages at the two points within 0.1 VDC. Adjust the Horizontal Output Bias adjustment, R217, to bring X1 and X2 to 0 V ± 0.1 VDC.

b. Connect an Oscilloscope to TP1 on the Horizontal board. On the PS950, rotate the TIME/DIV switch to the 1 us/DIV range. Depress the CH 1 button on the Display Mode switch.

c. On the test Oscilloscope set the controls to utilize the maximum resolution capability of the Oscilloscope while making the following two adjustments.

d. On the Horizontal board, adjust Sweep Zero adjustment, R110, for 0 VDC at the baseline portion of the sweep signal. The sweep signal is a 2 V, positive-going, ramp starting at 0 VDC.

e. On the Horizontal board, adjust Sweep Start capacitor, C50, for a smooth transition from the baseline portion of the waveform to the sweep portion. Any mis-adjustment will result in a positive-going or negative-going step in the sweep start. Disconnect the Oscilloscope from TP1.

f. Connect the Time Mark Generator to the CH 1 input. Depress the DC button on the CH 1 Input Coupling switch. Adjust the amplitude of the Generator for a suitable display. Select the 1 ms range of the Calibrator.

g. Rotate the TIME/DIV switch to the 1 ms/DIV range. On the Horizontal board, adjust the Horiz Cal control, R214, to obtain 1 time mark for each of the graticule lines. Adjust the Horizontal Position control as necessary.

h. Change the Time Mark Generator to the .1 msec range. Adjust Horizontal Position for sweep start at left edge of graticule. Pull the Horizontal Fine Position control out to obtain the X10 expander operation.

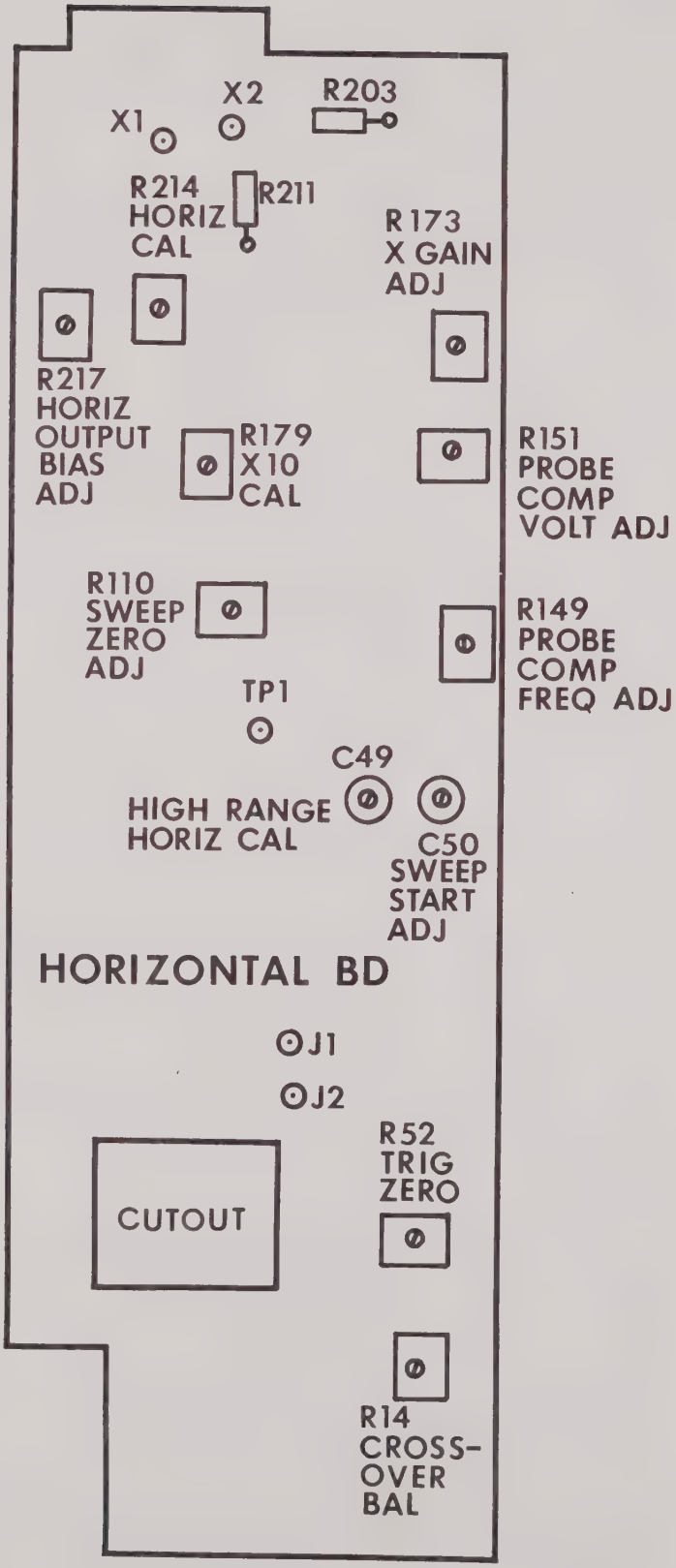

Figure 5-7. Horizontal board Adjustment Locations

i. On the Horizontal board, adjust the X10 Cal control, R179, to obtain 1 time marker for each of the graticule lines. Adjust the Fine Horizontal Position control as necessary. Depress the Sweep Magnifier.

j. Rotate the TIME/DIV switch to the 1 us/DIV range. Reset the Time Mark Generator to 1 us.

k. On the Horizontal board, adjust the High Range Horiz Cal capacitor C49, to obtain 1 time marker for each of the graticule lines. Adjust the Horizontal Position control as necessary.

l. Rotate the TIME/DIV switch to the .1 us/DIV range and pull the Sweep Magnifier. Connect the Constant Amplitude Generator to the CH 1 input. Set the amplitude for a suitable display. Set the frequency to approximately 10 MHz. Using the Fine Horizontal Position control, slowly move the display horizontally while observing the right edge of the display.

m. If there is any compression of the sine wave, or spreading of the sine wave at the left edge of the display, re-adjust the Horizontal Output Bias control, R217, to minimize both the spreading of the display at the left edge and the compression of the display at the right edge.

n. Rotate the TIME/DIV switch to the .2 us/DIV range. Set the frequency of the Generator to 50 MHz, verifying the frequency with the Frequency Counter. Depress the Sweep Magnifier.

o. Rotate the TIME/DIV switch to the 1 ms/DIV range. Depress the X-Y button on the Display Mode switch. Depress the Ch 2 DC button on the Input Coupling switch. Rotate the Ch 2 Vertical Sensitivity switch to the 5 mV/DIV range.

p. Connect the Constant Amplitude Generator to the Ch 2 input. Set the frequency of the Generator to 50 kHz. Set the amplitude control to 50 mV/DIV p-p output.

q. On the Horizontal board, adjust the X Gain adjustment, R173, for a full scale horizontal line.

5-20. PROBE COMPENSATION CALIBRATION

a. Connect the test Oscilloscope to the PROBE COMP tip jack on the Horizontal Front Panel. On the Horizontal board, adjust the Probe Comp Volt Adj, R151, for an output of 4.00 VDC ± 0.08 VAC.

b. Connect the Frequency Counter to the PROBE COMP tip jack on the Horizontal Front Panel. On the Horizontal board, adjust the Probe Comp Freq Adj. R149, for a frequency of 1.00 kHz ± 20 Hz.

5-21. MODEL 975 DMM-COUNTER CALIBRATION PROCEDURE

The following procedure provides the calibration steps required for calibrating the Model 975 DMM-Counter. Since the operating power for the DMM-Counter is derived from the PS950 Oscilloscope, the calibration procedure for the PS950 Oscilloscope should be performed prior to any attempt to calibrate the DMM-Counter.

5-22. Test Equipment Required

The following is the list of test equipment required to calibrate the DMM-Counter. Substitution of test equipment is authorized provided that the basic accuracy of the substituted equipment meets or exceeds the specified accuracy of the listed equipment.

1. Digital Voltmeter - Data Tech Model 30
2. Frequency Counter - H-P Model 5325A
3. Function Generator - H-P Model 3310A
4. DC Voltage Standard - .01% Accuracy
5. AC Voltage Standard - .01% Accuracy
6. Ohms Standard - .01% Accuracy

5-23. Location of Controls for Alignment

The location for the calibration controls and test points are illustrated in Fig. 5-8.

5-24. DMM-Counter Master Clock Calibration

a. Connect the Sine Wave Generator to both the Ch 1 Input BNC Connector and the Frequency Counter. Select the CH 1 positions of both DISPLAY MODE and TRIG SELECT switches on the PS950. Set the Generator frequency to approximately 80 kHz and the amplitude for a suitable triggered display on the CRT. On the DMM-Counter, depress the 100 kHz counter range.

b. Adjust the Master Clock calibration control, C1, until the digital display on the DMM-Counter agrees with the display of the external counter.

c. Increase the frequency of the Sine Wave Generator to approximately 160 kHz. Verify that the visible numbers on the flashing display of the DMM-Counter are within the specification limits of the DMM-Counter, in the over-range mode. Re-adjust the Clock calibration control, if required.

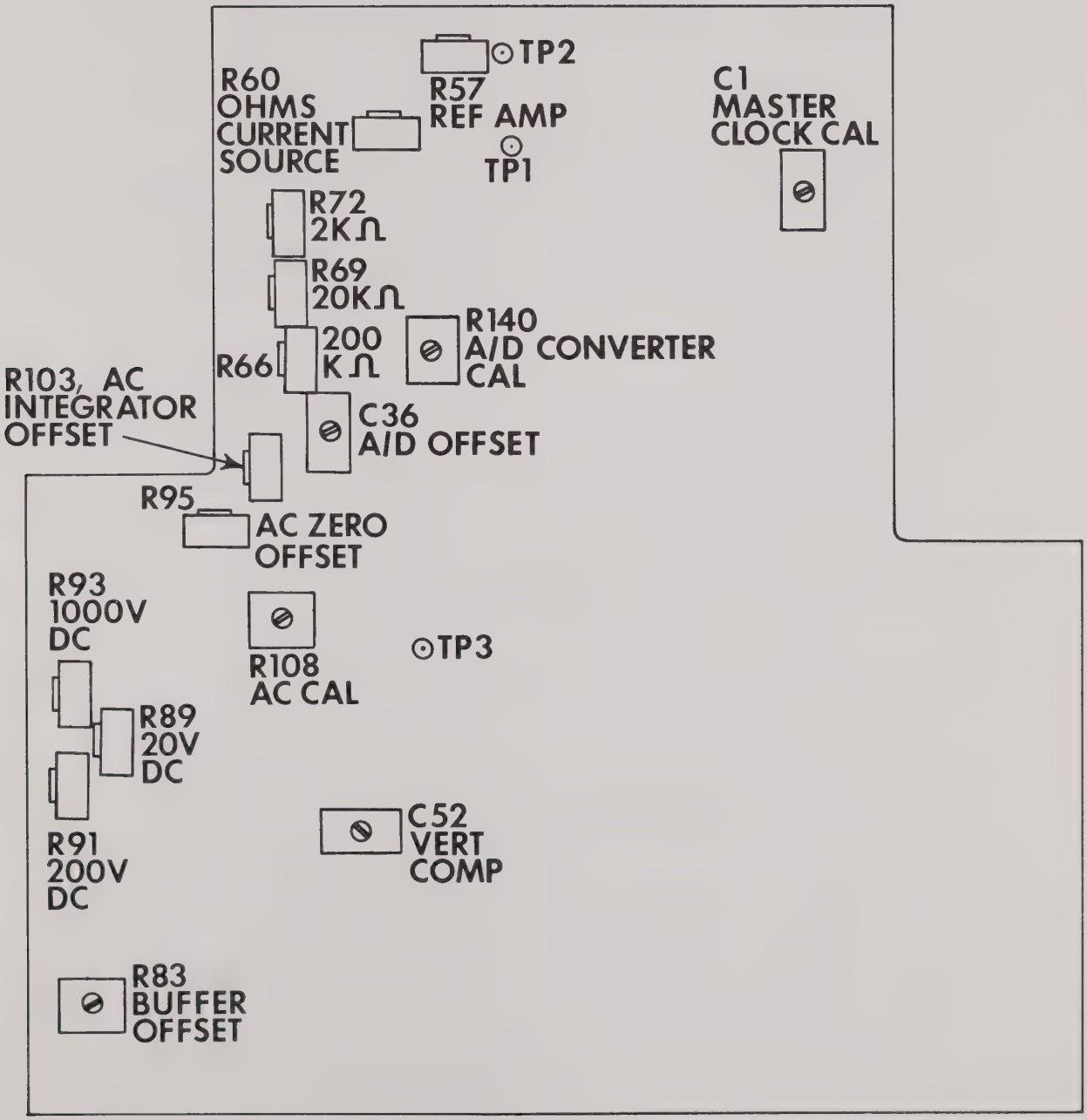

Figure 5-8. Model 975 board Adjustment Locations

5-25. Reference Voltage Calibration

a. Connect the plus and minus leads of the Digital Voltmeter across sensing resistor, R54, (test points are provided TP1 High, TP2-GND).

b. Adjust Reference amplifier control, R57, for a Digital Voltmeter reading of +0.60 VDC ± 0.001 VDC.

5-26. A-D Converter Zero Adjust

a. Place a jumper from analog ground (negative terminal of AUX INPUT) to the A-D converter input resistor (TP3). Depress DMM DCV function.

b. Adjust the A-D Converter Offset control, C36, for a DMM digital display of -0.000. Remove the jumper from TP3.

5-27. DC Voltage Offset Adjust

a. Connect a set of test leads to the DMM-Counter AUX INPUT connectors, short the probe ends of the test leads together.

b. Adjust Buffer Amplifier Offset control, R83, for a digital display of -0.000 VDC.

5-28. DC Voltage Calibration

a. Connect the AUX INPUT test leads to the DC voltage standard. Set the DC voltage standard for a voltage of +1.950 VDC.

b. Adjust the A-D Converter calibration control, R140, for a display of +1.950 VDC ± 1 digit.

c. Increase the output of the DC voltage standard to +19.95 VDC.

d. Adjust the Buffer Amplifier 20 volt range control, R89, for a DMM digital display of +19.95 VDC ± 1 digit.

e. Increase the output of the DC voltage standard to +195.0 VDC.

f. Adjust the Buffer Amplifier 200 volt range control, R91, for a DMM digital display of +195.0 VDC ± 1 digit.

g. Increase the output of the DC voltage standard to 1000 VDC.

h. Adjust the Buffer Amplifier 1000 volt range control, R93, for a DMM digital display of +1000 VDC ± 1 digit.

5-29. AC Converter Calibration

a. Turn off the input power, unsolder and remove the top shield from the DMM function switch and the two test points at the rear of the shield. Using a jumper cable, connect the end

of the jumper to the positive end of the tantalum capacitor, C29, and the other end to analog ground. Turn the input power back on. On the DMM-Counter, depress the ACV function.

b. Adjust the AC integrator offset control, R103, until the DMM digital display indicates an in-range reading (a flashing display is an out-of-range indication).

NOTE

With the integrating capacitor shorted out, the integrating amplifier is running. The previous adjustment (step b) eliminates the input offset voltage from the amplifier as a possible source of error. This adjustment may be a little difficult to set.

c. Turn off the input power and remove the jumper from the positime end of tantalum capacitor, C29. Replace and resolder the top shield to the two test points and the two rear contacts of the OHM switch. Turn the input power back on. Short the two AUX INPUT leads together.

d. Adjust the AC zero offset control, R95, for a DMM digital display of -0.000 VAC.

e. Connect the two AUX INPUT test leads to the AC voltage standard. Set the AC voltage standard for an output of 1.900 VAC at a frequency of 1 kHz.

f. Adjust the AC calibration control, R108, for a digital display of 1.900 VAC ± 1 digit.

5-30. Ohms Converter Calibration

a. On the DMM-Counter, depress the KOHMS function. Connect the AUX INPUT test leads to the Ohms standard. Set the Ohms standard for 1.950 Megohm.

b. Adjust the Ohms Converter Current source, R60, for a digital display of 195 kohms.

c. Decrease the Ohms standard to 195.0 kohms.

NOTE

In order to obtain the proper range, it may be necessary to momentarily depress the DCV function. This allows the DMM to uprange into the 200 kohm range since it cannot downrange with the value of ohms standard used for this range.

d. Adjust the 200 kohm range control, R66, for a digital display of 195.0 kohms ± 1 digit.

e. Decrease the ohms standard to 19.50 kohms.

f. Adjust the 20 kohm range control, R69, for a digital display of 19.50 kohm ± 1 digit.

g. Decrease the ohm standard to 1.950 kohm.

h. Adjust the 2 kohm range control, R72, for a digital display of 1.95 kohm ± 1 digit.

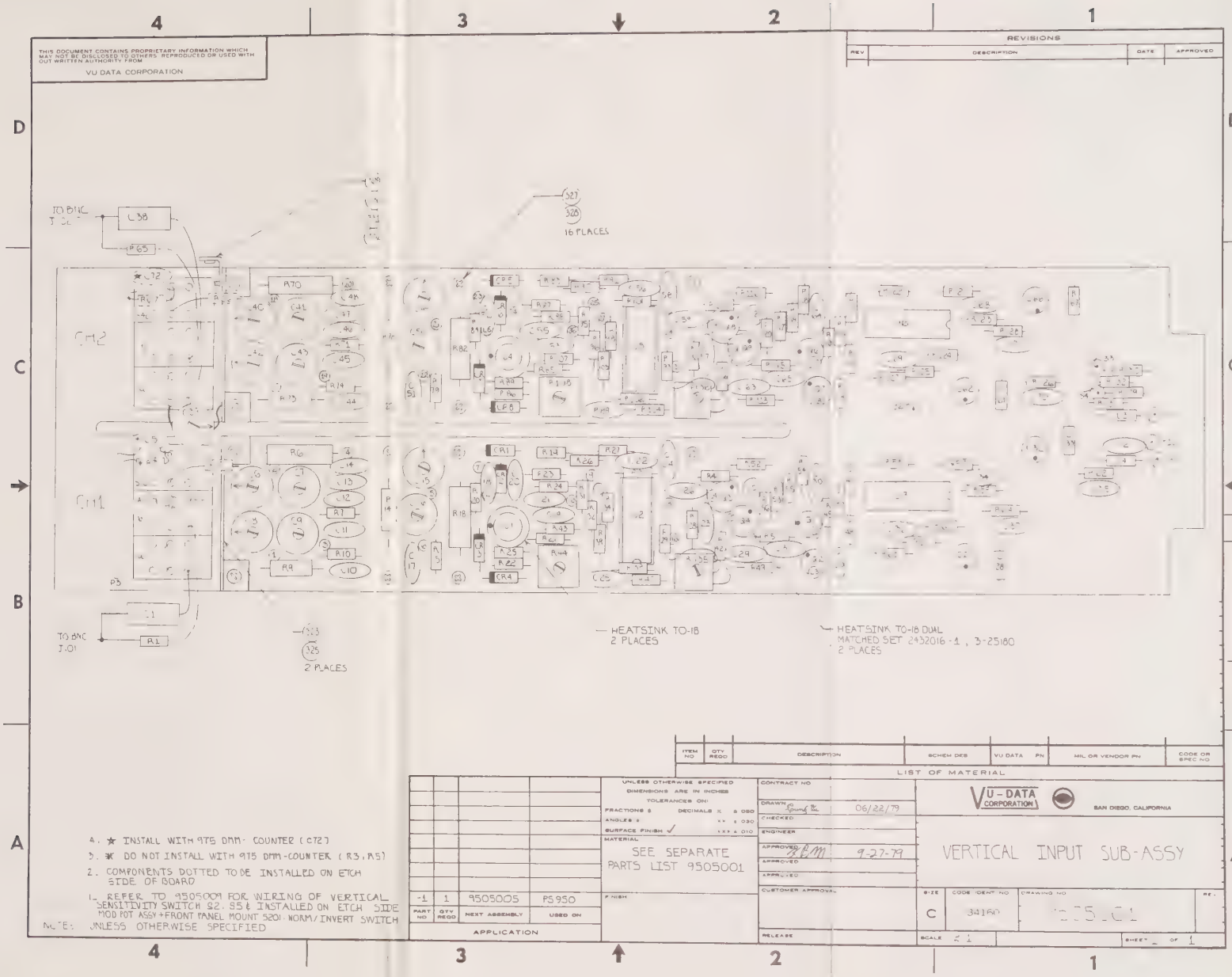
THIS DOCUMENT CONTAINS PROPRIETARY INFORMATION WHICH MAY NOT BE DISCLOSED TO OTHERS REPRODUCED OR USED WITH OUT WRITTEN AUTHORITY FROM
VU DATA CORPORATION
REVISIONS
REV
DESCRIPTION
DATE
APPROVED
TO BNC J.02
TO BNC J.01
16 PLACES
2 PLACES
HEATSINK TO-18 2 PLACES
HEATSINK TO-18 DUAL MATCHED SET 2452016-1, 3-25180 2 PLACES
4. ★ INSTALL WITH 975 DMM-COUNTER (C72)
3. ✱ DO NOT INSTALL WITH 975 DMM-COUNTER (R3, R5)
2. COMPONENTS DOTTED TO BE INSTALLED ON ETCH SIDE OF BOARD
1. REFER TO 9505009 FOR WIRING OF VERTICAL SENSITIVITY SWITCH S2, S5 & INSTALLED ON ETCH SIDE MOD POT ASSY+FRONT PANEL MOUNT 5201-NORM/INVERT SWITCH
NOTE: UNLESS OTHERWISE SPECIFIED
ITEM NO
QTY REQD
DESCRIPTION
SCHEM DES
VU DATA PN
MIL OR VENDOR PN
CODE OR SPEC NO
LIST OF MATERIAL
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON: FRACTIONS ± DECIMALS .X ± .050 ANGLES ± .XX ± .030 SURFACE FINISH ✓ .XXX ± .010
MATERIAL
SEE SEPARATE PARTS LIST 9505001
FINISH
-1 1 9505005 PS950
PART NO QTY REQD NEXT ASSEMBLY USED ON
APPLICATION
CONTRACT NO
DRAWN 06/22/79
CHECKED
ENGINEER
APPROVED 9-27-79
APPROVED
APPROVED
CUSTOMER APPROVAL
RELEASE
VU-DATA CORPORATION
SAN DIEGO, CALIFORNIA
VERTICAL INPUT SUB-ASSY
SIZE C
CODE IDENT NO 34160
DRAWING NO 9505C1
REV
SCALE 2:1
SHEET 1 OF 1

Figure 5-9. Parts Location for Vertical Input Sub-Assy 9505001

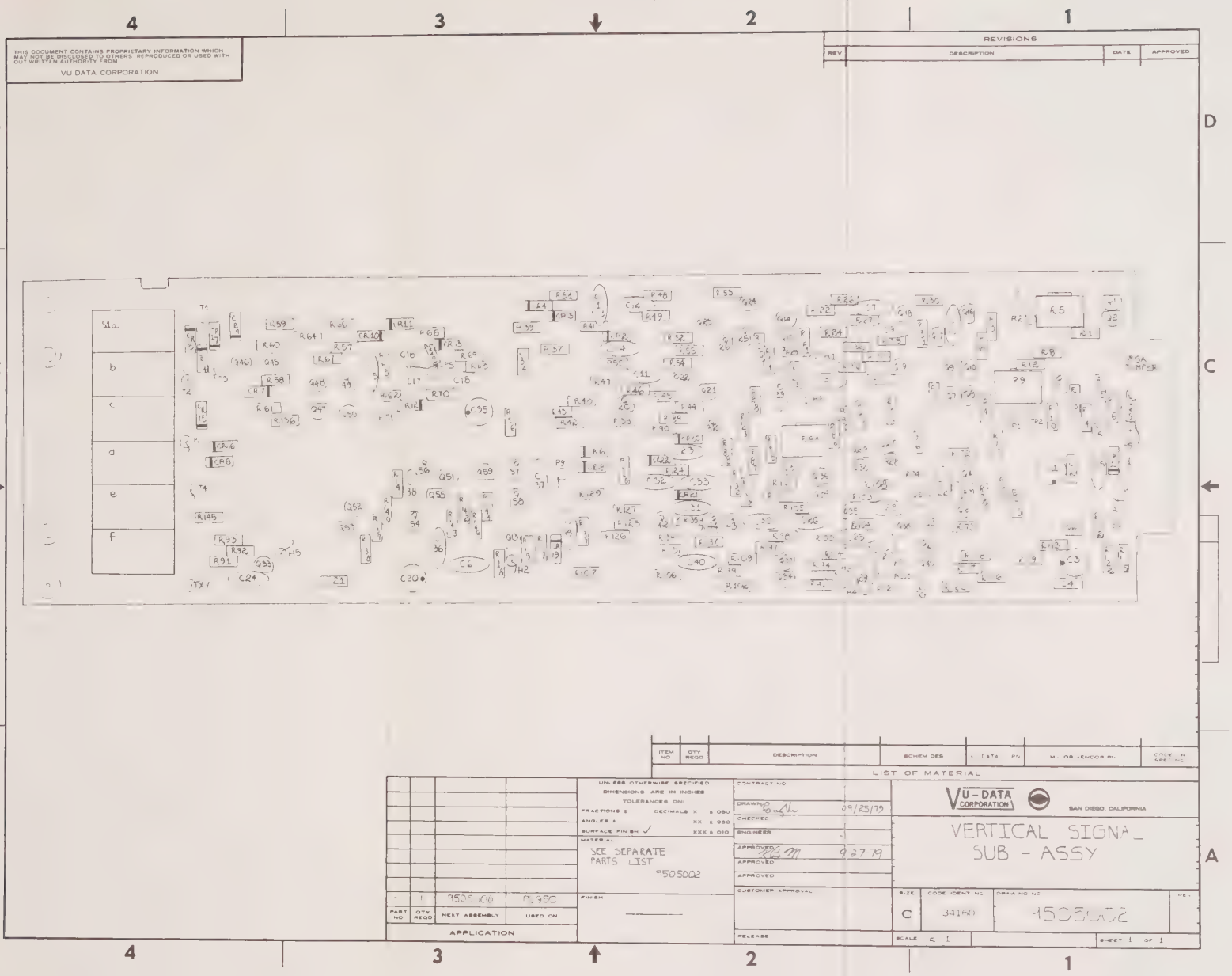

Figure 5-10. Parts Location for Vertical Signal Assy 9505002

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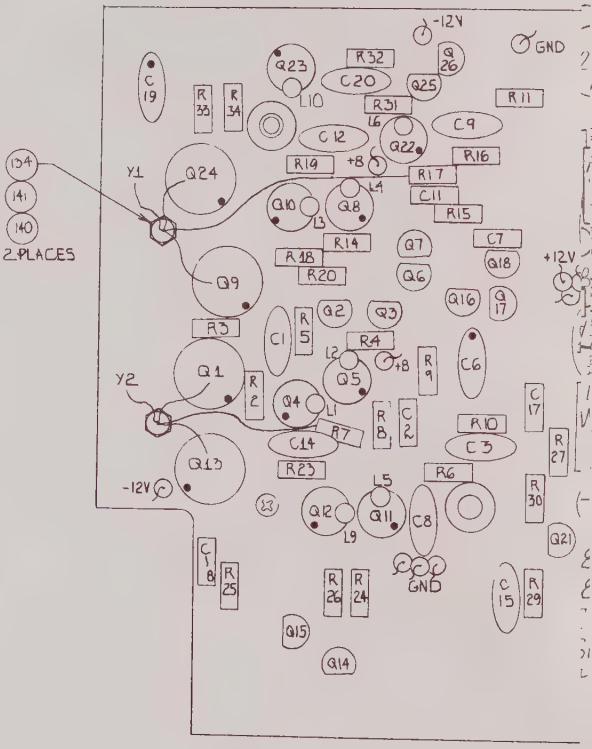


VERTICAL OUTPUT SUB ASSY 950500
-1 ASSY
SHOWN COMPONENT VIEW

NOTES: UNLESS OTHERWISE SPECIFIED.
1. REFERENCE TO INTERCONNECT DIAGRAM FOR WIRING
2. -N INDICATES NOMINAL VALUE.
3. J1 + J2 INSTALL ON ETCH SIDE OF VERTICAL INTERCONNECT BOARD.

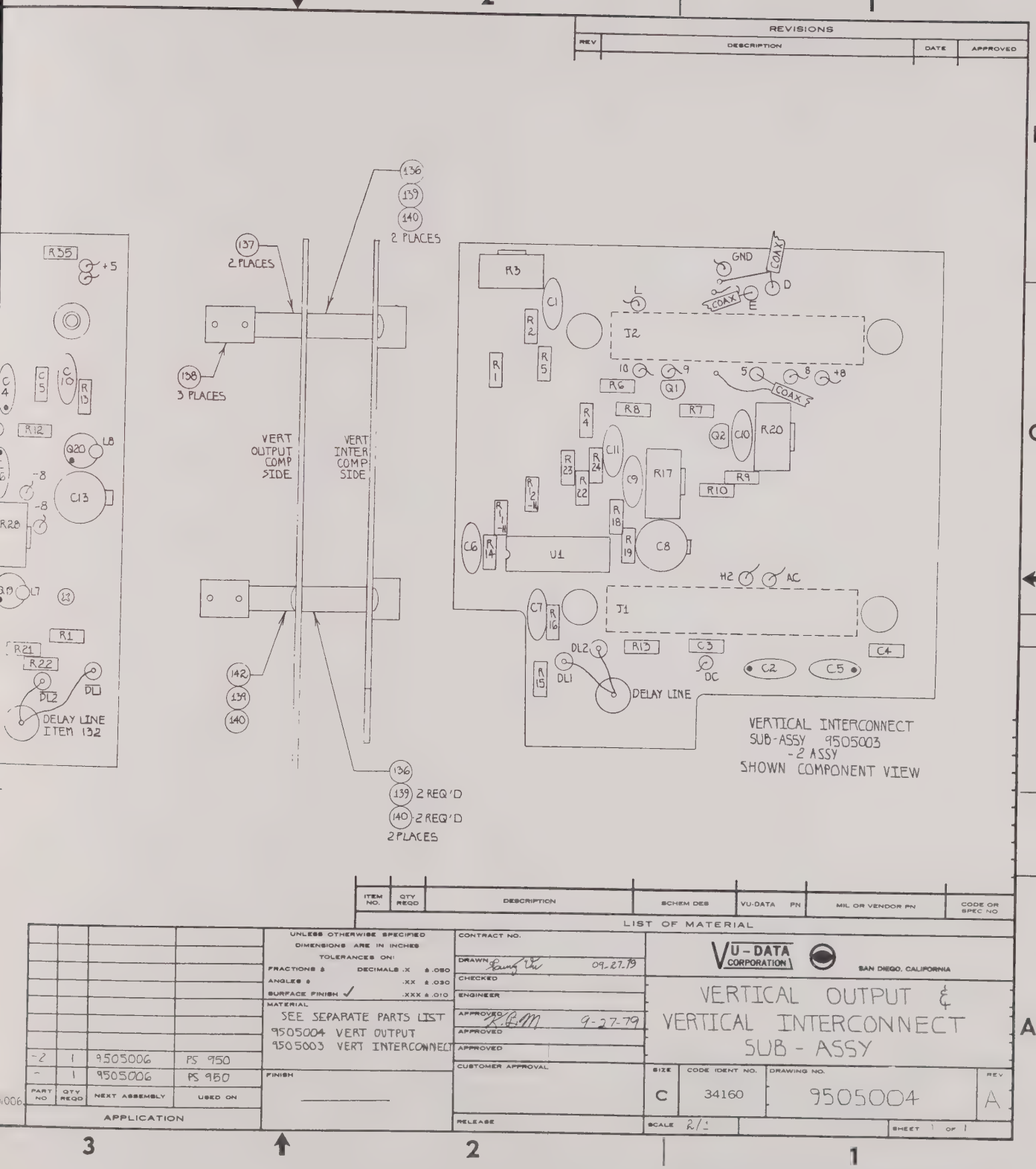


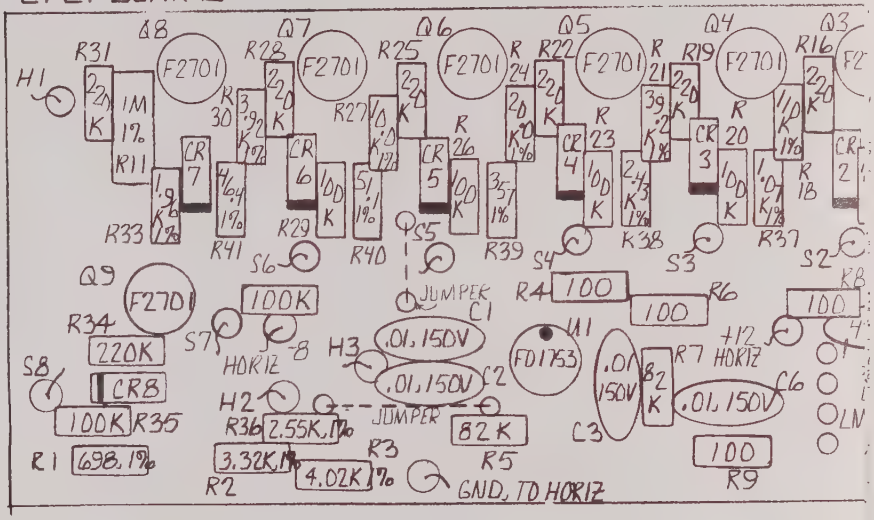
Figure 5-11. Parts Location for Vertical Interconnect Sub-Assy 9505003 and Vertical Output Sub-Assy 9505004

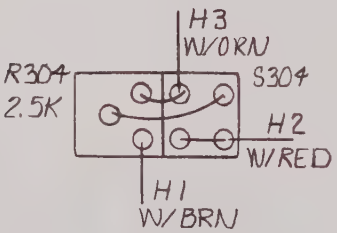
THIS DOCUMENT CONTAINS PROPRIETARY INFORMATION WHICH MAY NOT BE DISCLOSED TO OTHERS, REPRODUCED OR USED WITHOUT WRITTEN AUTHORITY FROM

VU-DATA CORPORATION

INSTALL 2 JUMPERS

C. C. BOARD





SIDE VIEW
MOD-POT ASSY
2432001-4
MOUNTS ON S301 SWITCH

ITEM NO.			
-1	1	9355008	PS950
-1	1	9355008	PS935
PART NO.	QTY REQD	NEXT ASSEMBLY	USED ON
APPLICATION			

UNLESS OTHERWISE
DIMENSIONS ARE IN
TOLERANCES
FRACTIONS ± DECIM
ANGLES ±
SURFACE FINISH ✓
MATERIAL
SEE 93550
PARTS LIST
9355008 PAR
FINISH

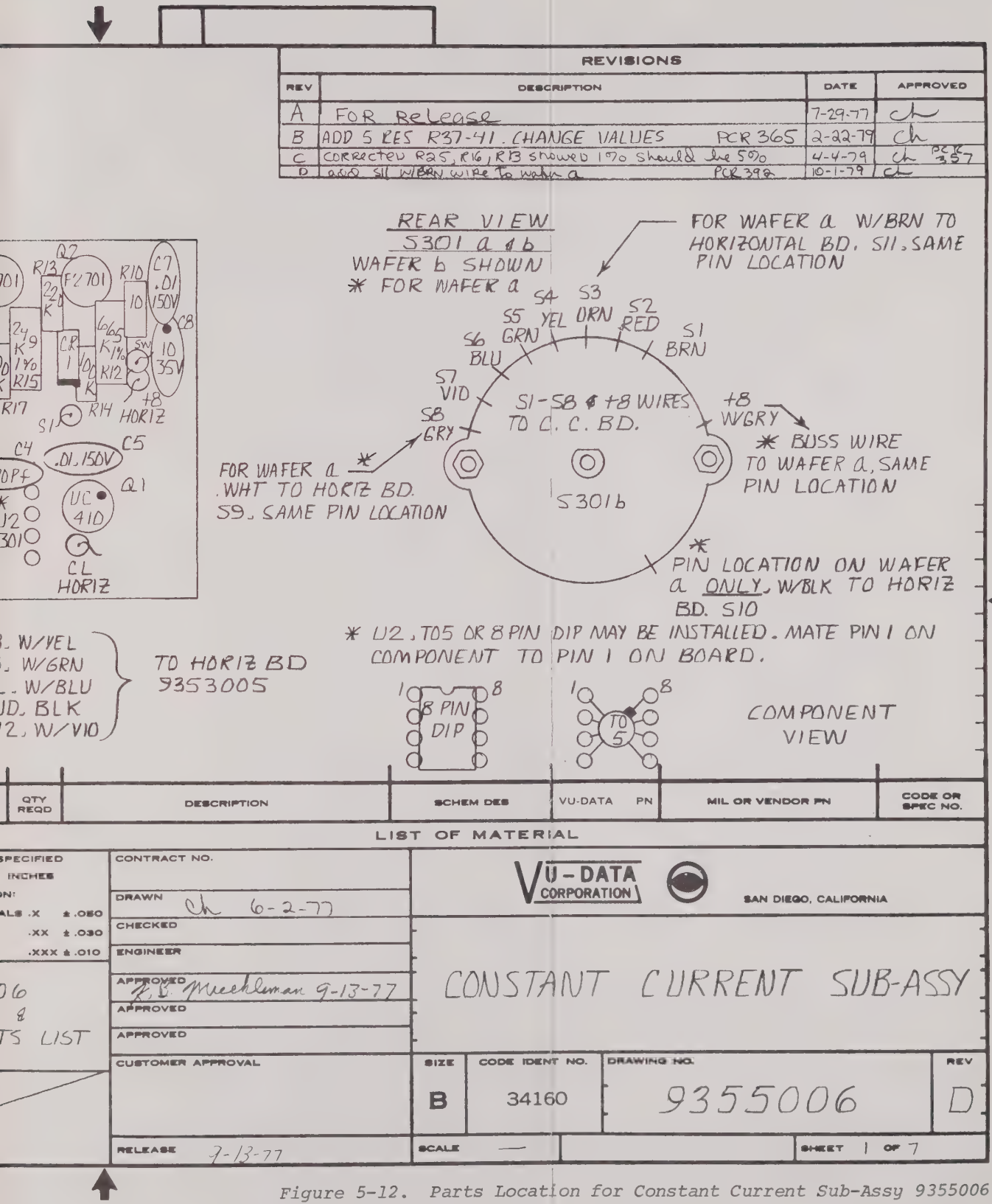
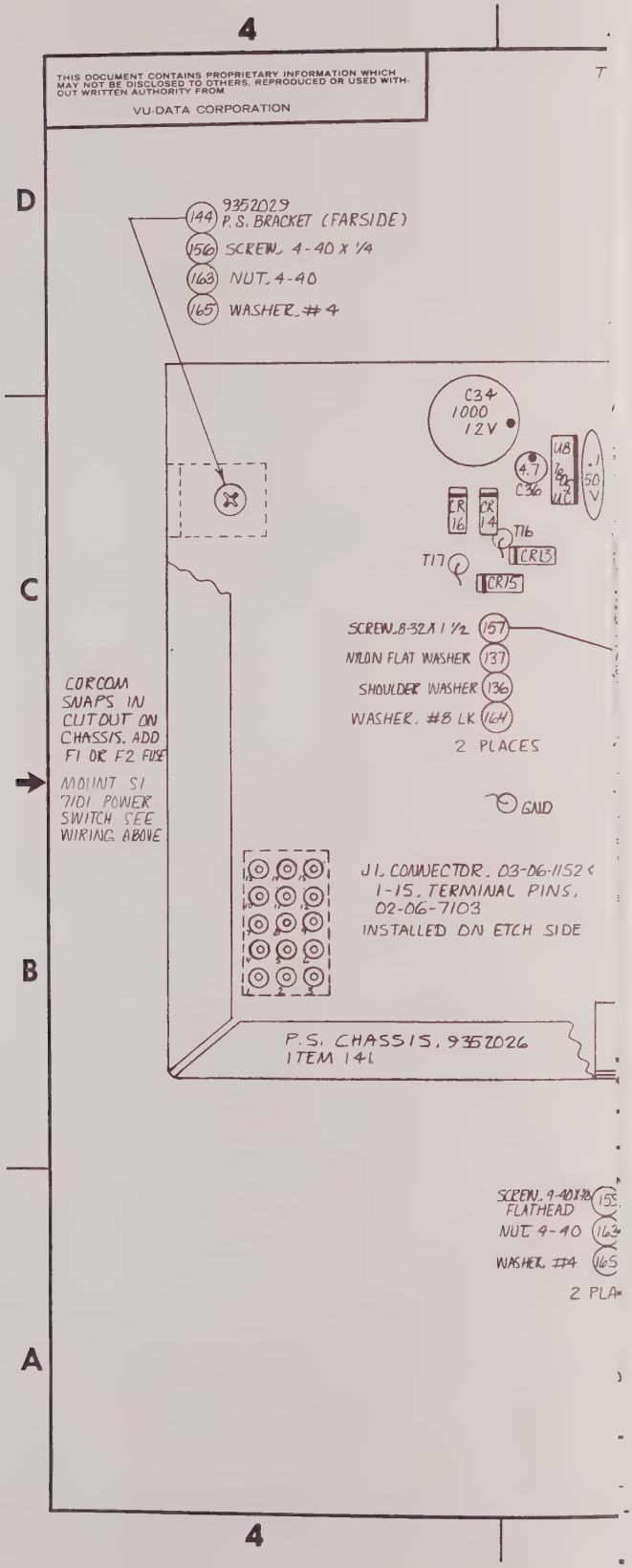

REVISIONS
REV | DESCRIPTION | DATE | APPROVED
A | FOR Release | 7-29-77 | ch
B | ADD 5 RES R37-41. CHANGE VALUES PCR 365 | 2-22-79 | ch
C | CORRECTED R25, R16, R13 SHOWED 1% should be 5% | 4-4-79 | ch PCR 357
D | ADD S11 W/BRN WIRE To wafer a PCR 398 | 10-1-79 | ch
REAR VIEW
S301 a & b
WAFER b SHOWN
* FOR WAFER a
FOR WAFER a W/BRN TO HORIZONTAL BD. S11, SAME PIN LOCATION
S4 S3 S5 YEL ORN S2 RED S1 BRN S6 GRN S7 VIO S8 GRY S9 BLU
S1-S8 & +8 WIRES TO C.C. BD.
+8 W/GRY
* BUSS WIRE TO WAFER a, SAME PIN LOCATION
FOR WAFER a * WHT TO HORIZ BD. S9, SAME PIN LOCATION
S301b
* PIN LOCATION ON WAFER a ONLY, W/BLK TO HORIZ BD. S10
* U2, TO5 OR 8 PIN DIP MAY BE INSTALLED. MATE PIN 1 ON COMPONENT TO PIN 1 ON BOARD.
8 PIN DIP
TO 5
COMPONENT VIEW
W/YEL
W/GRN
W/BLU
BLK
W/VIO
TO HORIZ BD 9353005
Q2 R13 F/Z 701 R10 C7 .01 150V C8 10 35V R9 24K R15 1% R17 CR1 R11 0 K R12 665K 1% SW1 R14 +8 HORIZ C4 .01 150V C5 Q1 UC 410 CL HORIZ
QTY REQD | DESCRIPTION | SCHEM DES | VU-DATA PN | MIL OR VENDOR PN | CODE OR SPEC NO.
LIST OF MATERIAL
CONTRACT NO.
DRAWN ch 6-2-77
CHECKED
ENGINEER
APPROVED R.B. Meechleman 9-13-77
APPROVED
APPROVED
CUSTOMER APPROVAL
RELEASE 7-13-77
VU-DATA CORPORATION SAN DIEGO, CALIFORNIA
CONSTANT CURRENT SUB-ASSY
SIZE B | CODE IDENT NO. 34160 | DRAWING NO. 9355006 | REV D
SCALE —
SHEET 1 OF 7

Figure 5-12. Parts Location for Constant Current Sub-Assy 9355006


4
THIS DOCUMENT CONTAINS PROPRIETARY INFORMATION WHICH MAY NOT BE DISCLOSED TO OTHERS, REPRODUCED OR USED WITHOUT WRITTEN AUTHORITY FROM
VU-DATA CORPORATION
D
C
B
A
9352029
144 P.S. BRACKET (FARSIDE)
156 SCREW, 4-40 X 1/4
163 NUT, 4-40
165 WASHER, #4
C34
1000
12V
4.7
C36
.1
50
V
CR16
CR14
T16
CR13
T17
CR15
SCREW, 8-32 X 1 1/2 157
NYLON FLAT WASHER 137
SHOULDER WASHER 136
WASHER, #8 LK 164
2 PLACES
GND
CORCOM SWAPS IN CUTOUT ON CHASSIS. ADD F1 OR F2 FUSE
MOUNT S1 7101 POWER SWITCH SEE WIRING ABOVE
J1 CONNECTOR, 03-06-1152 & 1-15 TERMINAL PINS, 02-06-7103
INSTALLED ON ETCH SIDE
P.S. CHASSIS, 9352026
ITEM 141
SCREW, 4-40 X 3/8 FLATHEAD 153
NUT 4-40 163
WASHER #4 165
2 PLA
4

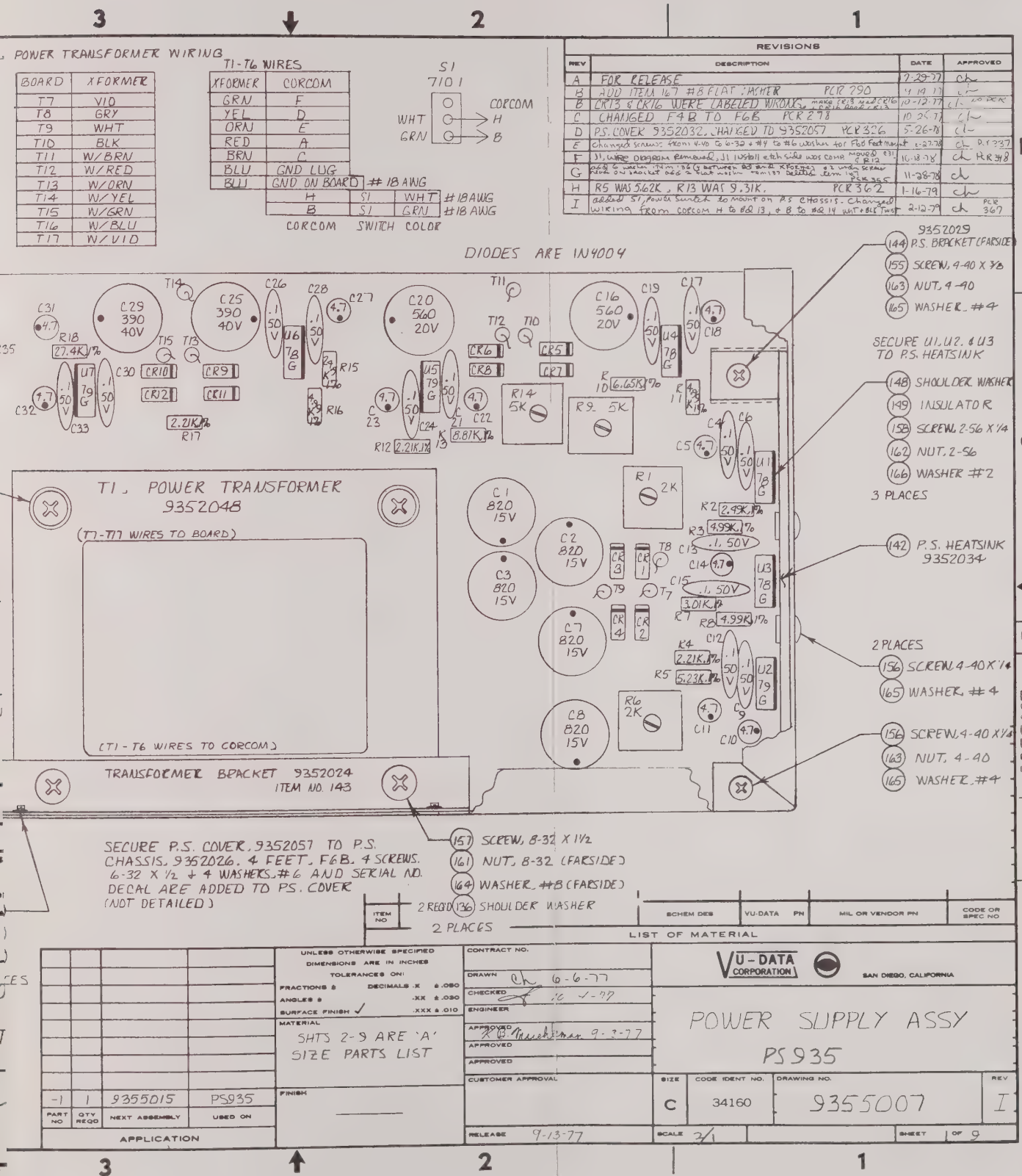

POWER TRANSFORMER WIRING
BOARD | XFORMER
T7 VIO
T8 GRY
T9 WHT
T10 BLK
T11 W/BRN
T12 W/RED
T13 W/ORN
T14 W/YEL
T15 W/GRN
T16 W/BLU
T17 W/VIO
T1-T6 WIRES
XFORMER | CORCOM
GRN F
YEL D
ORN E
RED A
BRN C
BLU GND LUG
BLU GND ON BOARD # 18 AWG
H S1 WHT #18AWG
B S1 GRN #18 AWG
CORCOM SWITCH COLOR
S1 7101
CORCOM
WHT H
GRN B
REVISIONS
REV | DESCRIPTION | DATE | APPROVED
A FOR RELEASE 7-29-77 ch
B ADD ITEM 167 #8 FLAT WASHER PCR 290 9-19-77 ch
C CHANGED F4B TO F6B PCR 298 10-25-77 ch
D P.S. COVER 9352032, CHANGED TO 9352057 PCR 326 5-26-78 ch
E Changed screws from 4-40 to 6-32 + #4 to #6 washer for F6B Feet mount 6-27-78 ch
F J1 WIRE DIAGRAM REMOVED, J1 INSTALLED each side was COMP moved 831 C R12 10-18-78 ch PCR 348
G add 6 washer item 132 (between R3 and XFORMER) & 2 under screws item 147 PCR 355 11-28-78 ch
H R5 WAS 5.62K, R13 WAS 9.31K. PCR 362 1-16-79 ch
I added S1, power switch to mount on PS chassis. Changed wiring from CORCOM H to #2 13, & B to #2 14 WHT + BLK Twist 2-12-79 ch PCR 367
DIODES ARE IN4004
T1, POWER TRANSFORMER 9352048
(T1-T17 WIRES TO BOARD)
(T1-T6 WIRES TO CORCOM)
TRANSFORMER BRACKET 9352024 ITEM NO. 143
9352029 P.S. BRACKET (FARSIDE)
144 P.S. BRACKET (FARSIDE)
155 SCREW, 4-40 X 3/8
163 NUT, 4-40
165 WASHER #4
SECURE U1, U2, & U3 TO P.S. HEATSINK
148 SHOULDER WASHER
149 INSULATOR
158 SCREW, 2-56 X 1/4
162 NUT, 2-56
166 WASHER #2
3 PLACES
142 P.S. HEATSINK 9352034
2 PLACES
156 SCREW, 4-40 X 1/4
165 WASHER, #4
156 SCREW, 4-40 X 1/4
163 NUT, 4-40
165 WASHER, #4
SECURE P.S. COVER, 9352057 TO P.S. CHASSIS, 9352026. 4 FEET, F6B. 4 SCREWS. 6-32 X 1/2 + 4 WASHERS, #6 AND SERIAL NO. DECAL ARE ADDED TO P.S. COVER (NOT DETAILED)
157 SCREW, 8-32 X 1 1/2
161 NUT, 8-32 (FARSIDE)
164 WASHER, #8 (FARSIDE)
2 REQ'D 136 SHOULDER WASHER
2 PLACES
ITEM NO | SCHEM DES | VU-DATA PN | MIL OR VENDOR PN | CODE OR SPEC NO
LIST OF MATERIAL
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON: FRACTIONS ± DECIMALS .X ± .080 ANGLES ± .XX ± .030 SURFACE FINISH ✓ .XXX ± .010
MATERIAL SHTS 2-9 ARE 'A' SIZE PARTS LIST
FINISH
CONTRACT NO.
DRAWN ch 6-6-77
CHECKED
ENGINEER
APPROVED
APPROVED
APPROVED
CUSTOMER APPROVAL
RELEASE 9-13-77
VU-DATA CORPORATION SAN DIEGO, CALIFORNIA
POWER SUPPLY ASSY PS935
SIZE C CODE IDENT NO. 34160 DRAWING NO. 9355007 REV I
SCALE 2/1 SHEET 1 OF 9
PART NO -1 | QTY REQD 1 | NEXT ASSEMBLY 9355015 | USED ON PS935
APPLICATION
9355007

Figure 5-13. Parts Location for Power Supply Assy 9355007

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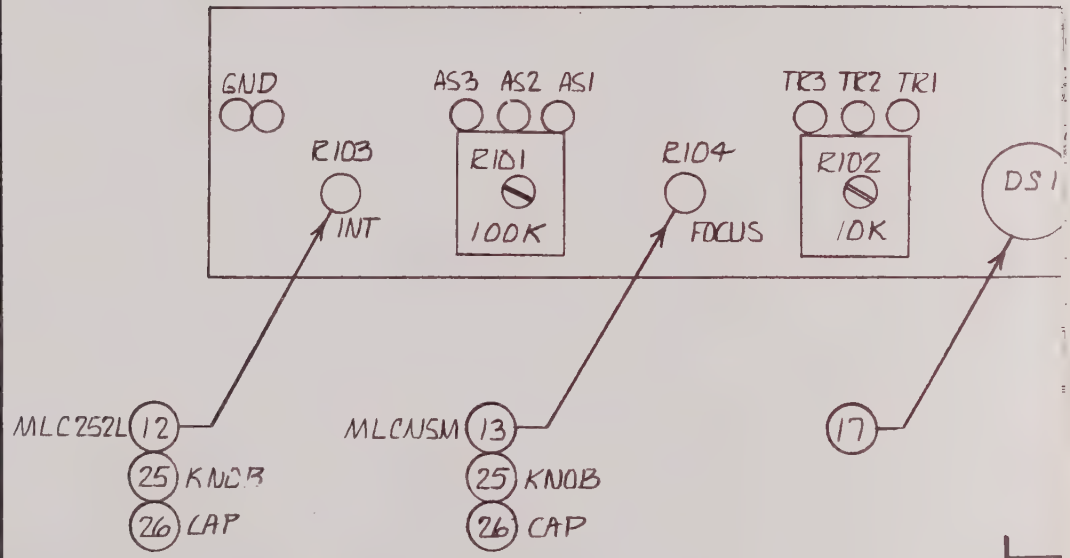
B	R102 WAS 50K. NOW 10K Pc
C	PCR 339. CHANGED PARTS LIST F.F
D	CHANGED K101 FROM IMD
E	REMOVE S101 & ADD DS1. DELE

REFER TO W
9351014

COMPONENT SIDE



ITEM NO.

PART NO.	QTY REQD	NEXT ASSEMBLY	USED ON
-1	1	9355D14	PS935

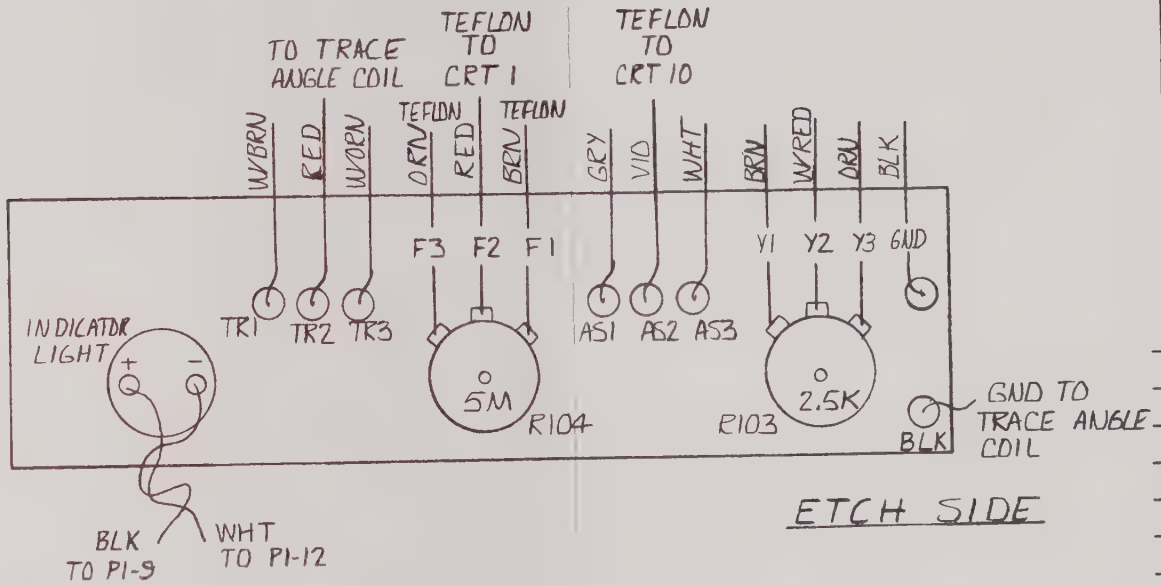
APPLICATION

UNLESS OTHERWISE
DIMENSIONS ARE IN
TOLERANCES
FRACTIONS ± DECIM
ANGLES ±
SURFACE FINISH ✓
MATERIAL
SHTS 2 0 3
SIZE PARTS
FINISH

R 296	CL	10-18-77
POTS TO R SERIES	CL	7-31-78
TO 100K, PCR351	11-6-78	CL
TE HARDWARE	2-13-79	CL PCR 367

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
A	FOR RELEASE	7-18-77	CL

IRING DIAGRAM



QTY REQD	DESCRIPTION	SCHEM DES	VU-DATA PN	MIL OR VENDOR PN	CODE OR SPEC NO.

LIST OF MATERIAL

SPECIFIED
INCHES
ON:
ALS .X ±.050
.XX ±.030
.XXX ±.010

ARE 'A' LIST

CONTRACT NO.

DRAWN CL 6-27-77
CHECKED
ENGINEER
APPROVED R B Mueller 9-13-77
APPROVED
APPROVED

CUSTOMER APPROVAL

RELEASE 7-13-77

VU-DATA CORPORATION SAN DIEGO, CALIFORNIA

CRT CONTROL BD. SUB-ASSY PS935

SIZE	CODE IDENT NO.	DRAWING NO.	REV
B	34160	9355009	E

SCALE 2/1 SHEET 1 OF 3

Figure 5-14. Parts Location for CRT Control Sub-Assy 9355009

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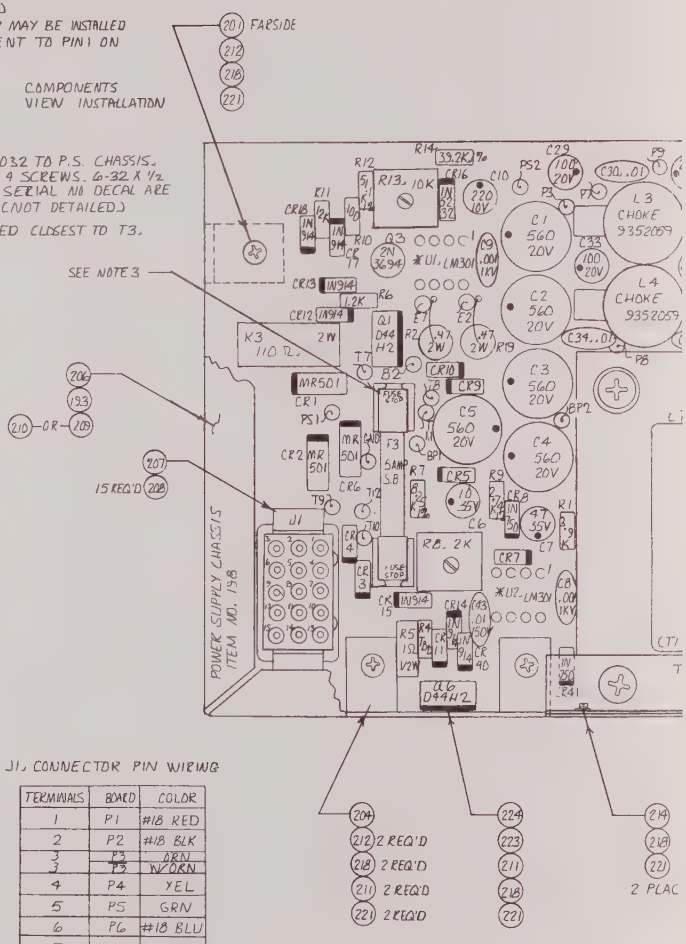
NOTES: UNLESS OTHERWISE SPECIFIED

1. INSTALL 9 JUMPERS W1-W9
2. DIODES ARE IN4004
3. FUSE STOP ON CLIP MUST BE ON OUTSIDE (BOTH SIDES)
4. * U1, U2, TO5 OR 8 PIN DIP MAY BE INSTALLED MATE PIN 1 ON COMPONENT TO PIN 1 ON BOARD.

5. SECURE P.S. COVER, 9352032 TO P.S. CHASSIS. 9352064, 4 FEET, F6B, 4 SCREWS, 6-32 X 1/2 AND 4 WASHERS #6 AND SERIAL NO DECAL ARE ADDED TO P.S. COVER (NOT DETAILED)
6. J9, RED CONN IS INSTALLED CLOSEST TO T3, TRANSFORMER.



T3, XFORMER WIRING

BOARD	XFORMER
T7	V10
T8	GRY
T9	WHT
T10	BLK
T11	W/BRN
T12	W/RED

XFORMER	CORCOM
GRN	F
YEL	D
ORN	E
RED	A
BRN	C
BLU	GND LUG
BLU	GND ON BOARD #18

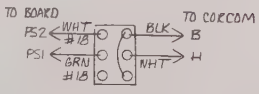
J1, CONNECTOR PIN WIRING

TERMINALS	BOARD	COLOR
1	P1	#18 RED
2	P2	#18 BLK
~~3~~	~~P3~~	~~ORN~~
3	P3	W/ORN
4	P4	YEL
5	P5	GRN
6	P6	#18 BLU
7	P7	V10
8	P8	GRY
9	P9	#18 WHT
10	P10	BLK
11	P11	W/BRN
12	P12	W/RED

BOARD	TO	COLOR
BP1	J9 RED CONN	#18 RED
BP2	J8 BLK CONN	#18 BLK
PS1	S1 PWR SW	#18 GRN
PS2	S1 PWR SW	#18 WHT

S1 PWR SW	B, CORCOM	BLK
S1 PWR SW	H, CORCOM	WHT

S1
POWER SWITCH
7203 W/ROCKER



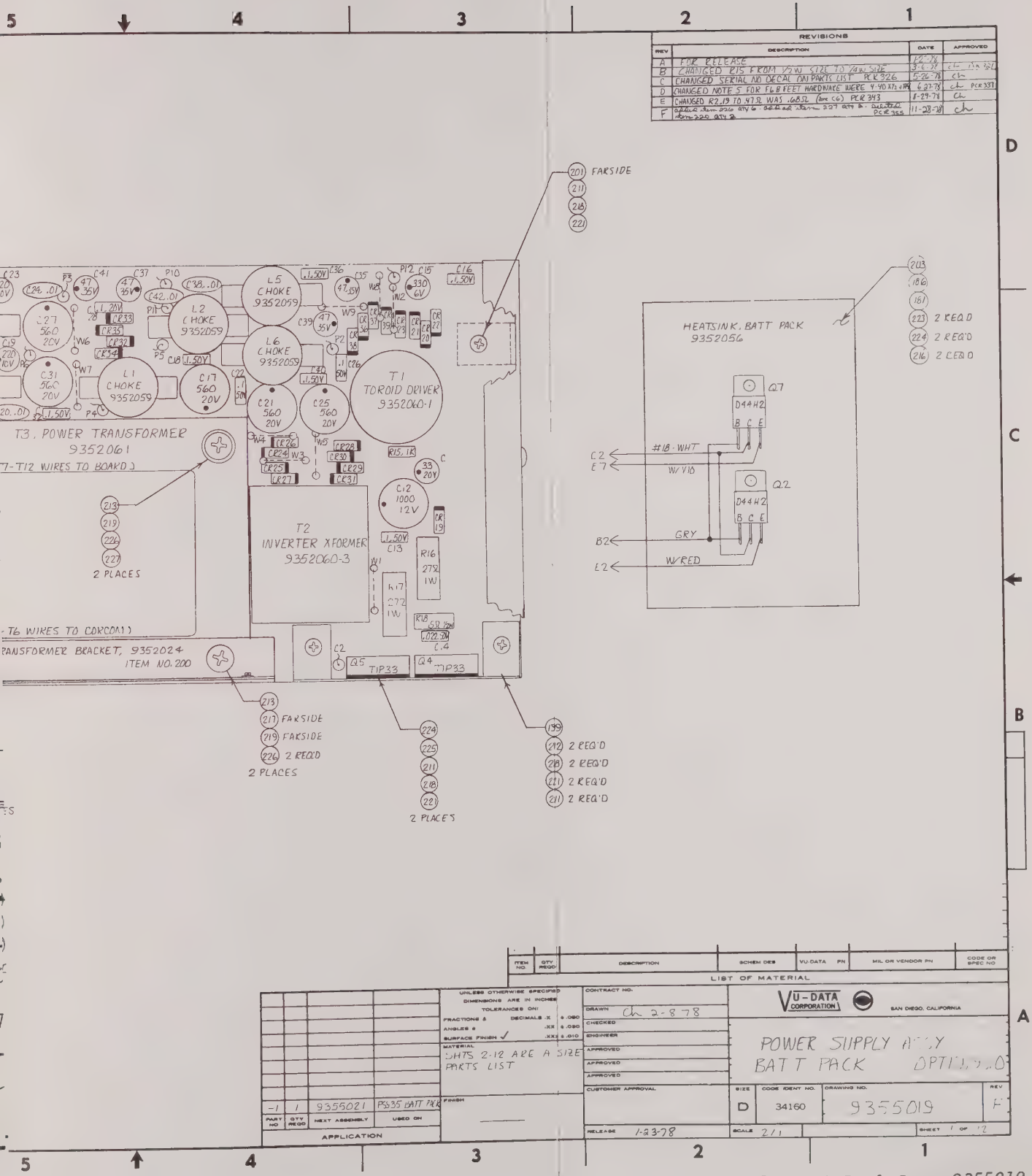


Figure 5-15. Parts Location for Power Supply Batt Pack Assy 9355019

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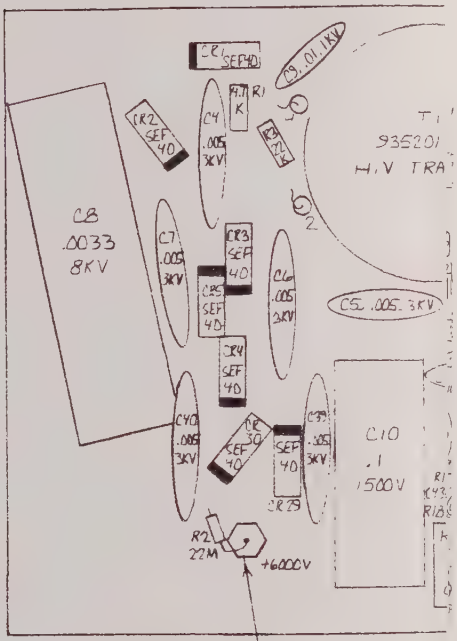
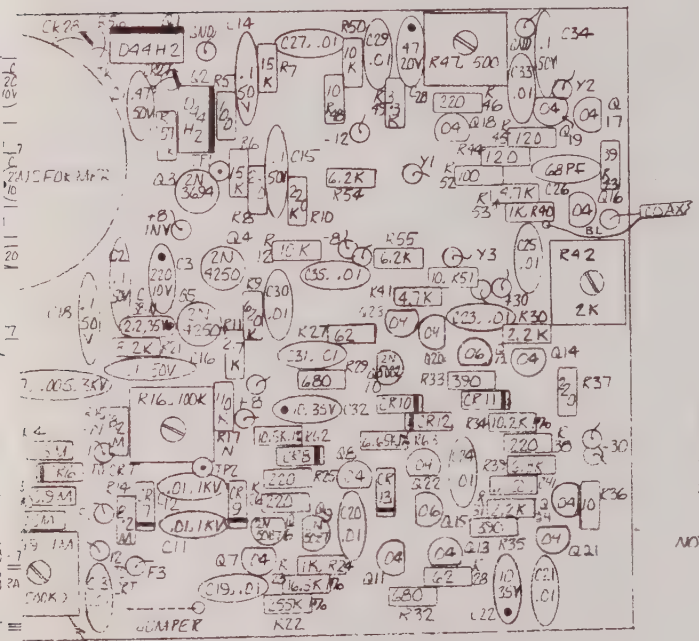


REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
A	FOR RELEASE PCR 353	11-8-78	ch
B	ADDED NOTE 7 FOR PARENTHESIS FOR TELEFUNKEN	11-10-78	ch
C	ADDED Q20-23, R58-63. DELETED CR19-26 Changed values of CR9-13 from 3.1000 TO 1.1000 SEE NOTE 6 PER 357	12-4-78	ch
D	Change R17 TO 120K WAS 110K (3 ASSY) PIS NOW NOM VAL	1-9-79	ch
E	DELETED R58-61 CADDED Q23+Q24 PCR372	3-22-79	ch
F	R17 IS 110K IN FOR ALL APPLIC WAS 120K Telefunken	4-19-79	ch
G	C41 WAS 1.1KV 1.1000 pF NOW .1, 50V NO P.R. C3 NOW 150V WAS 500V PCR 379	5-16-79 5-23-79	ch ch

SEE WIRING DIAGRAM, 9351014
(FOR TELEFUNKEN CRT SEE WIRING DIAGRAM, 9351024)



7. VALUES IN PARENTHESIS ARE FOR TELEFUNKEN CRT. (CR13, 17, 19)
6. DIODES ARE IN914.
4. TP1 & TP2 TO BE INSTALLED
3. -N INDICATES NOMINAL VALUE
2. TRANSISTORS Q1 ARE 2N3504, Q6 ARE 2N3906
1. JUMPER TO BE INSTALLED

NOTES: UNLESS OTHERWISE SPECIFIED

ITEM NO	QTY REQD	DESCRIPTION	SCHEM DES	V. DATA PN	MIL OR VENDOR PN	CODE OF SPEC NO
		LIST OF MATERIAL				

PART NO	QTY REQD	NEXT ASSEMBLY	USED ON
-1	1	9505006	PS950
	1	9355014	PS935

APPLICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON: FRACTIONS ± DECIMALS .X ±.030, .XX ±.030, ANGLES ± .XXX ±.010, SURFACE FINISH ✓
MATERIAL: SHTS 2-11 ARE VA SIZE PARTS LIST (FOR TELEFUNKEN CRT SEE 9355024 PARTS LIST)
FINISH

CONTRACT NO.
DRAWN Ch 11-8-78
CHECKED
ENGINEER
APPROVED RCM 11-10-78
APPROVED
APPROVED
CUSTOMER APPROVAL
RELEASE 11-10-78

VU-DATA CORPORATION SAN DIEGO, CALIFORNIA

6KV HIGH VOLTAGE SUB-ASSY

SIZE	CODE IDENT NO.	DRAWING NO.	REV
C	34160	9355025	G

SCALE 2/1 SHEET 1 OF 11

Figure 5-16. Parts Location for High Voltage Sub-Assy 9355025

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VU-DATA CORPORATION

8 7 6

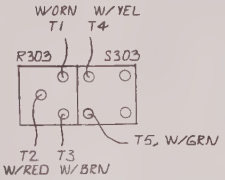
D C B A

REFER TO HORIZ ASSY 9355008

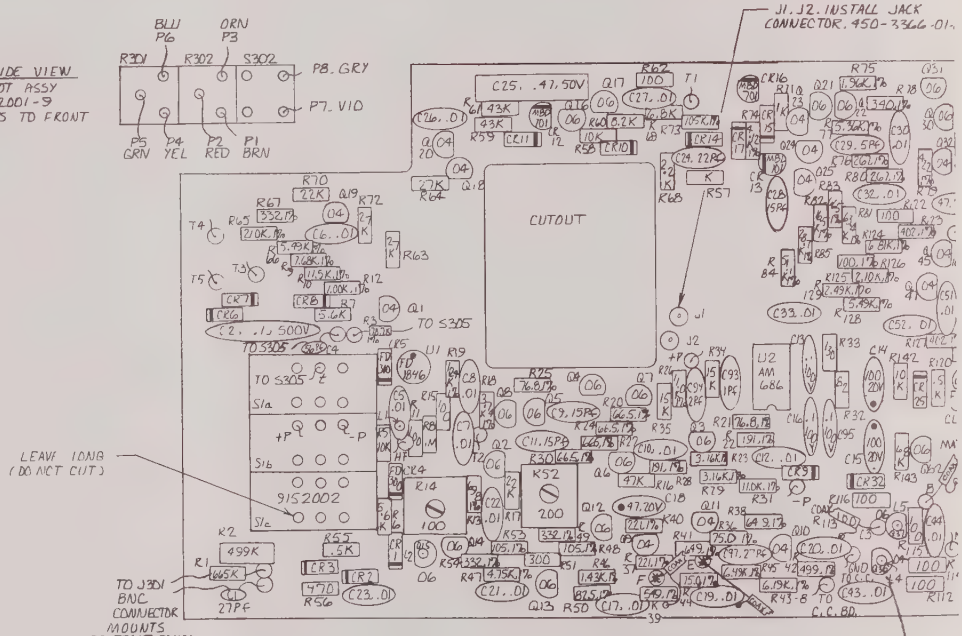
BD TO BD WIRING

FROM	TO	COLOR
X1	X1	BUSS
X2	X2	BUSS
+8	+8	GRN
N	N	YEL
B	B	COAX (WHT PIGTAIL)
C3	C3	COAX (BLK PIGTAIL)
E	E	75Ω (RED PIGTAIL)
F	F	75Ω (BLK PIGTAIL)
ON S16 SWITCH -P	-P	VIO
ON S16 SWITCH +P	+P	ORN

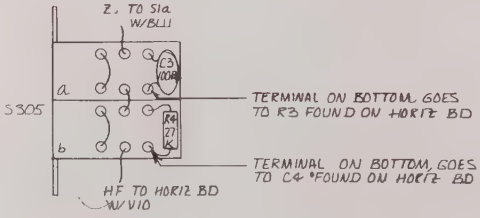
SIDE VIEW
MOD-POT ASSY
2432001-1
MOUNTS TO FRONT PANEL



SIDE VIEW
MOD-POT ASSY
2432001-9
MOUNTS TO FRONT PANEL



TOP VIEW
FILTER SELECT SWITCH
93520C1 MOUNTS TO FRONT PANEL SPACERS
SEE HORIZ ASSY 9355008


Z, TO S1a W/BLU
S305
a
b
TERMINAL ON BOTTOM GOES TO R3 FOUND ON HORIZ BD
TERMINAL ON BOTTOM, GOES TO C4 FOUND ON HORIZ BD
HF TO HORIZ BD W/VIO

8 7 6

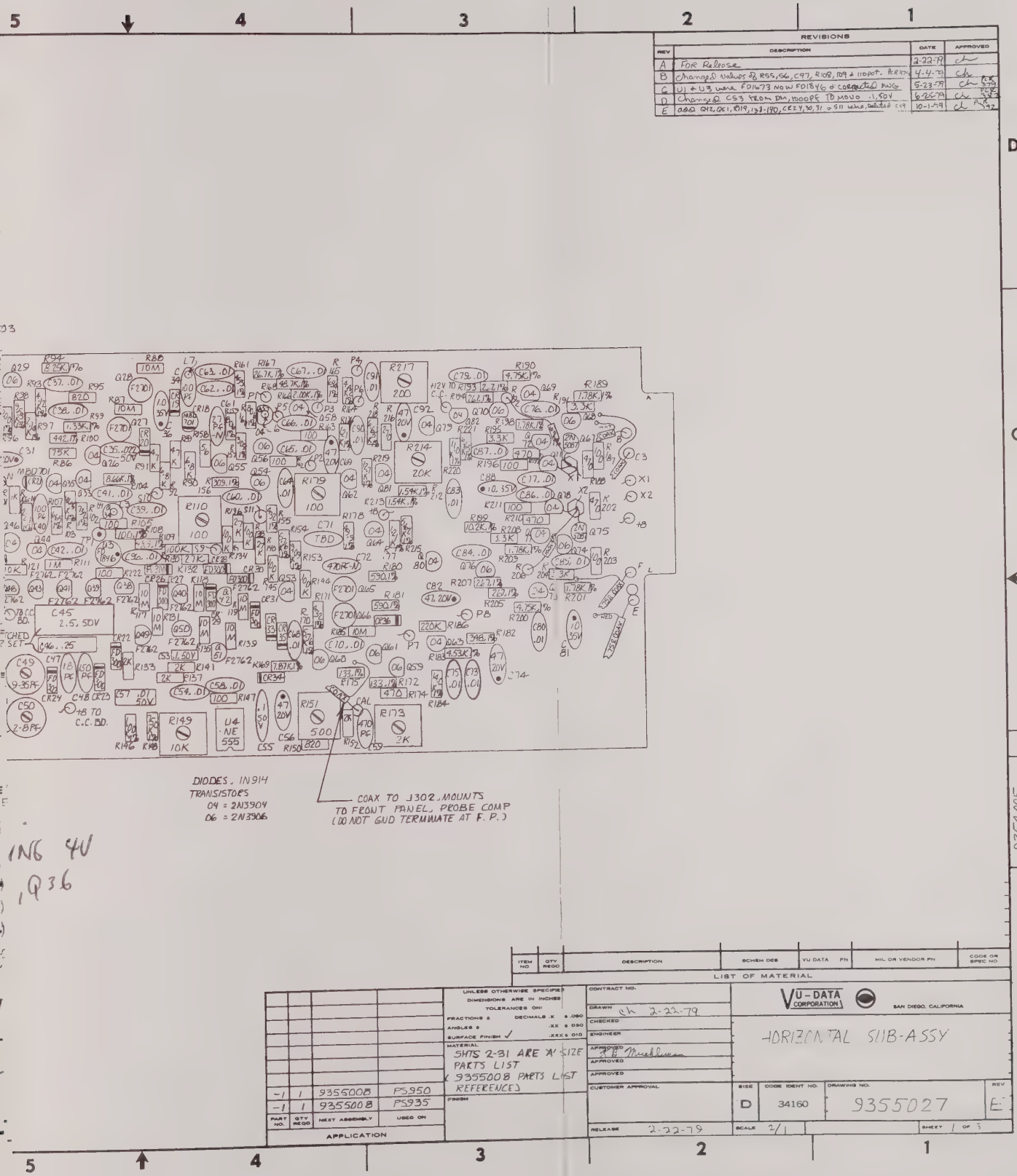


Figure 5-17. Parts Location for Horizontal Sub-Assy 9355027

THIS DOCUMENT CONTAINS PROPRIETARY INFORMATION WHICH MAY NOT BE DISCLOSED TO OTHERS. REPRODUCED OR USED WITH OUT WRITTEN AUTHORITY FROM
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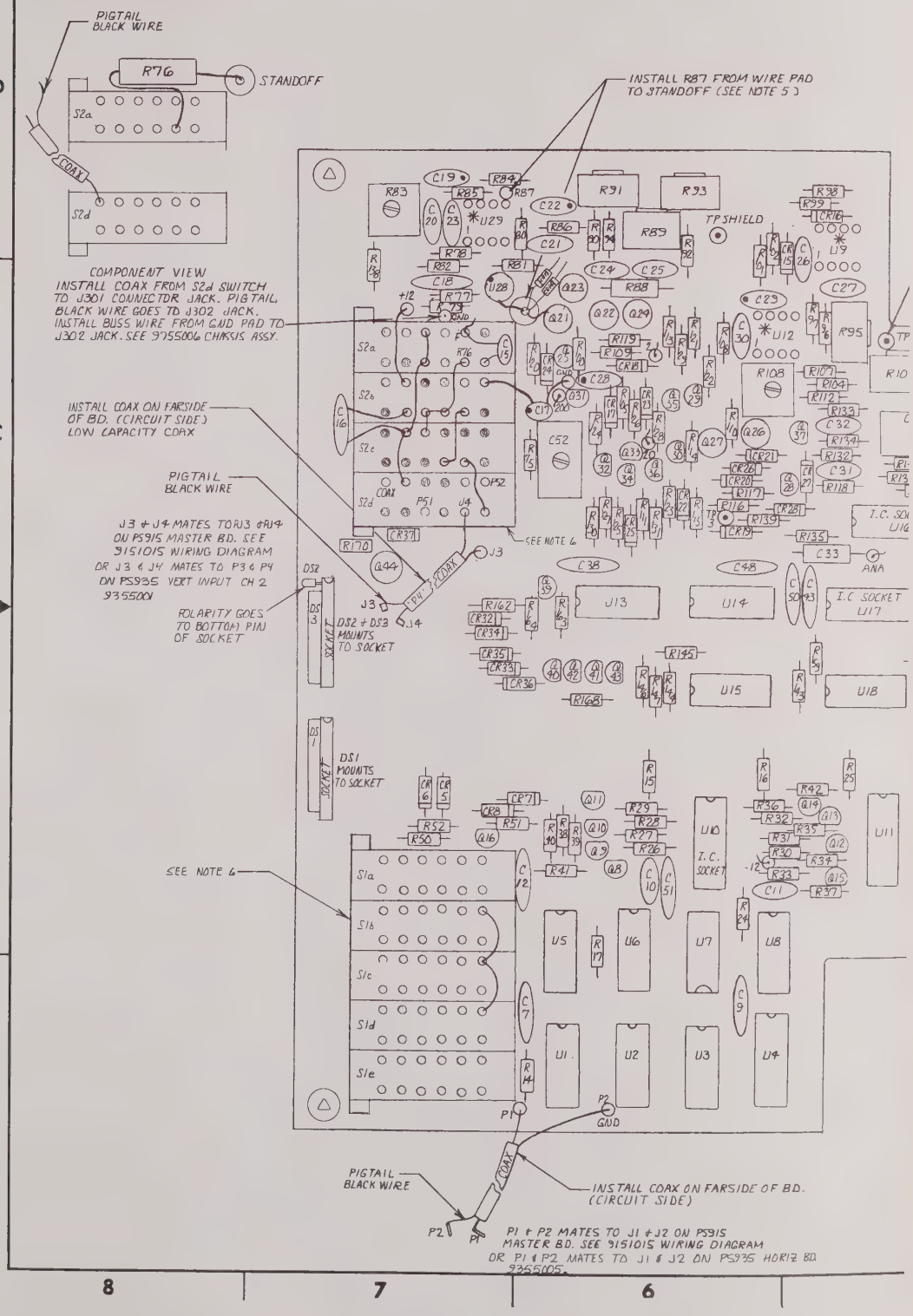
PIGTAIL BLACK WIRE
R76
STANDOFF
S2a
COAX
S2d
COMPONENT VIEW
INSTALL COAX FROM S2d SWITCH TO J301 CONNECTOR JACK. PIGTAIL, BLACK WIRE GOES TO J302 JACK. INSTALL BUSS WIRE FROM GND PAD TO J302 JACK. SEE 9755006 CHASSIS ASSY.
INSTALL R87 FROM WIRE PAD TO STANDOFF (SEE NOTE 5)
INSTALL COAX ON FARSIDE OF BD. (CIRCUIT SIDE) LOW CAPACITY COAX
PIGTAIL BLACK WIRE
J3 & J4 MATES TO RJ3 & RJ4 ON PS915 MASTER BD. SEE 915101S WIRING DIAGRAM OR J3 & J4 MATES TO P3 & P4 ON PS935 VERT INPUT CH 2 935500N
POLARITY GOES TO BOTTOM PIN OF SOCKET
DS2
DS3
SOCKET
DS2 & DS3 MOUNTS TO SOCKET
J3
J4
P4
COAX
SEE NOTE 6
TP SHIELD
I.C. SOCKET U17
DS1
DS1 MOUNTS TO SOCKET
SEE NOTE 6
I.C. SOCKET
P1
P2
GND
PIGTAIL BLACK WIRE
INSTALL COAX ON FARSIDE OF BD. (CIRCUIT SIDE)
P1 & P2 MATES TO J1 & J2 ON PS915 MASTER BD. SEE 915101S WIRING DIAGRAM OR P1 & P2 MATES TO J1 & J2 ON PS935 HORIZ BD 935500S.

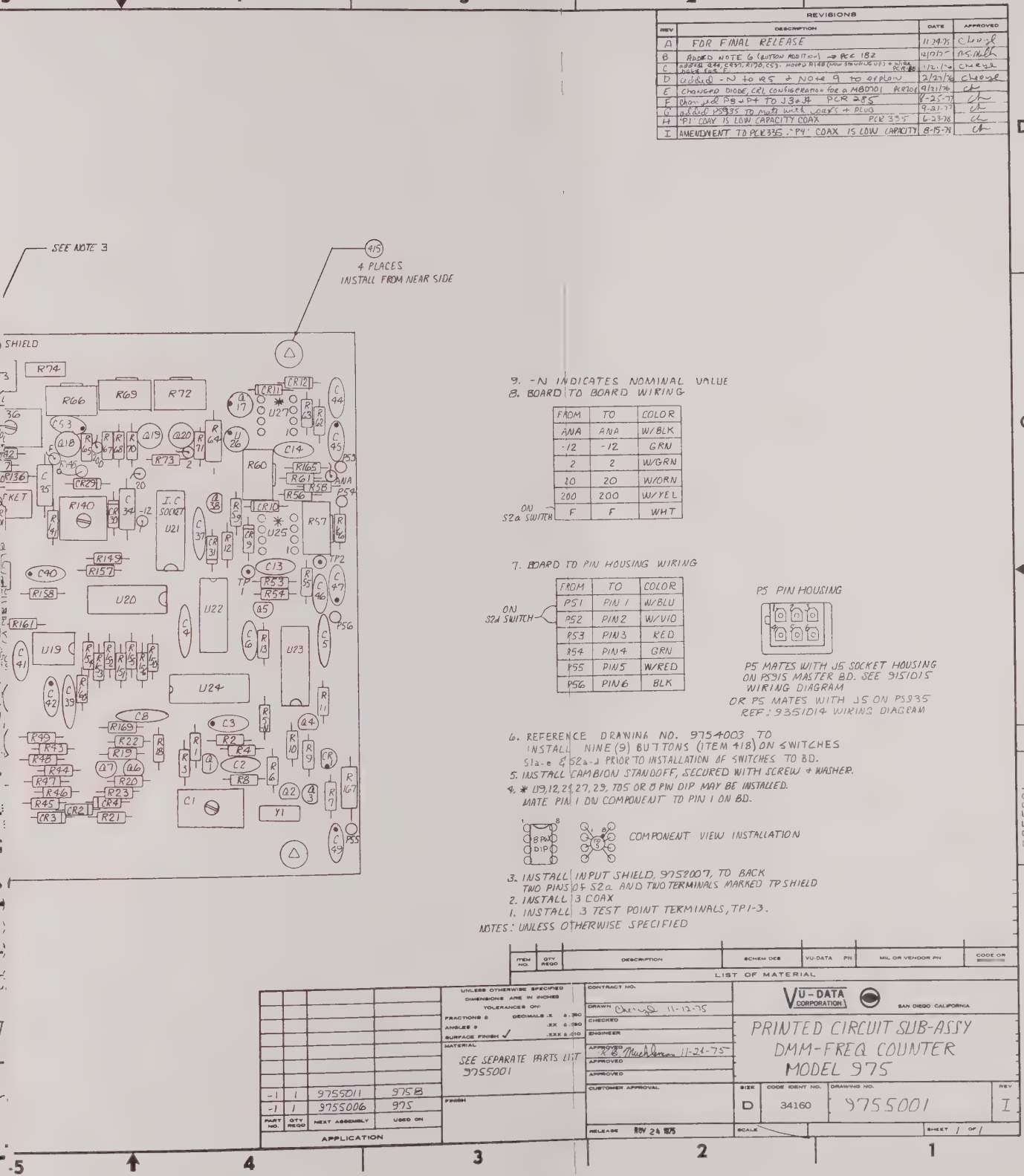
REVISIONS
REV | DESCRIPTION | DATE | APPROVED
A FOR FINAL RELEASE 11-24-75 Chung
B ADDED NOTE 6 (BUTTON ADDITION) → PCR 182 12/17/75 M.S. Mulh
C ADDED R44, CR37, R170, CR38. MOVED R148 (NOW SHOWN AS U23) & R166 PCR 186 1/2/176 CHUNG
D added -N to R5 & NOTE 9 to explain 2/27/76 CHUNG
E CHANGED DIODE, CR1, CONFIGURATION FOR A MB7001 PER208 9/21/76
F Changed PS WIRE TO J3 & J4 PCR 285 8-25-77
G added PS935 TO MATE WITH J5 & PLUG 9-21-77
H 'P1' COAX IS LOW CAPACITY COAX PCR 335 6-23-78
I AMENDMENT TO PCR335 - 'P4' COAX IS LOW CAPACITY 8-15-78
SEE NOTE 3
4 PLACES INSTALL FROM NEAR SIDE
SHIELD
9. -N INDICATES NOMINAL VALUE
8. BOARD TO BOARD WIRING
FROM | TO | COLOR
ANA | ANA | W/BLK
-12 | -12 | GRN
2 | 2 | W/GRN
20 | 20 | W/ORN
200 | 200 | W/YEL
ON S2a SWITCH F | F | WHT
7. BOARD TO PIN HOUSING WIRING
ON S2d SWITCH
FROM | TO | COLOR
PS1 | PIN 1 | W/BLU
PS2 | PIN 2 | W/VIO
PS3 | PIN 3 | RED
PS4 | PIN 4 | GRN
PS5 | PIN 5 | W/RED
PS6 | PIN 6 | BLK
P5 PIN HOUSING
P5 MATES WITH J5 SOCKET HOUSING ON PS915 MASTER BD. SEE 915101S WIRING DIAGRAM
OR P5 MATES WITH J5 ON PS935 REF: 935101H WIRING DIAGRAM
6. REFERENCE DRAWING NO. 9754003 TO INSTALL NINE (9) BUTTONS (ITEM 418) ON SWITCHES S1a-e & S2a-d PRIOR TO INSTALLATION OF SWITCHES TO BD.
5. INSTALL CAMBION STANDOFF, SECURED WITH SCREW & WASHER.
4. * U9, 12, 24, 27, 29, TO5 OR 8 PIN DIP MAY BE INSTALLED. MATE PIN 1 ON COMPONENT TO PIN 1 ON BD.
8 PIN DIP
COMPONENT VIEW INSTALLATION
3. INSTALL INPUT SHIELD, 9752007, TO BACK TWO PINS OF S2a AND TWO TERMINALS MARKED TP SHIELD
2. INSTALL 3 COAX
1. INSTALL 3 TEST POINT TERMINALS, TP1-3.
NOTES: UNLESS OTHERWISE SPECIFIED
ITEM NO. | QTY REQD | DESCRIPTION | SCHEM DES | VU-DATA PN | MIL OR VENDOR PN | CODE OR
LIST OF MATERIAL
-1 | 1 | 9755011 | 975B
-1 | 1 | 9755006 | 975
PART NO. | QTY REQD | NEXT ASSEMBLY | USED ON
APPLICATION
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON: FRACTIONS ± DECIMALS .X ± .100 .XX ± .030 .XXX ± .010 ANGLES ± SURFACE FINISH ✓ MATERIAL
SEE SEPARATE PARTS LIST 9755001
FINISH
CONTRACT NO.
DRAWN Chung 11-12-75
CHECKED
ENGINEER
APPROVED R.B. Mulhern 11-24-75
APPROVED
APPROVED
CUSTOMER APPROVAL
RELEASE NOV 24 1975
VU-DATA CORPORATION SAN DIEGO CALIFORNIA
PRINTED CIRCUIT SUB-ASSY DMM-FREQ COUNTER MODEL 975
SIZE D | CODE IDENT NO. 34160 | DRAWING NO. 9755001 | REV I
SCALE
SHEET 1 OF 1
9755001
5 4 3 2 1
D C B A

Figure 5-18. Parts Location for DMM-Counter Sub-Assy 9755001

SECTION VI

PARTS LIST

Mfg. Code Number	Manufacture	Location
00853	Sangamo	Marion, Illinois
01121	Allen Bradley	Milwaukee, Wisconsin
01295	Texas Instruments	Dallas, Texas
04062	Elmenco	New York, New York
04713	Motorola	Phoenix, Arizona
05397	Kemet	Cleveland, Ohio
06540	Amatom	New Rochelle, New York
07263	Fairchild	Mt. View, California
12406	Elpac	Fullerton, California
14099	Semtech Corp.	Newbury Park, California
14752	Electrocube	S. Pasadena, California
15818	Amelco	Mt. View, California
24913	Specialty Connector, Co.	Indianapolis, Indiana
26533	Zero	Burbank, California
27556	IMB	Santa Fe Springs, California
28520	Heyman Mfg., Co. (Heyco)	Kenilworth, New Jersey
34160	Vu-Data Corp.	San Diego, California
44655	Ohmite Mfg., Co.	Skokie, Illinois
46384	Penn Engineering	Doylestown, Pennsylvania
56289	Sprague	North Adams, Massachusetts
71450	CTS	Elkhart, Indiana
71590	Centralab	Milwaukee, Wisconsin
72619	Dialight Corp.	Brooklyn, New York
75915	Littlefuse	Des Plaines, Illinois
76055	Mallory	Frankfort, Indiana
78488	Stackpole	St. Mary's Pennsylvania
78553	Tinnerman Products	Cleveland, Ohio
80294	Bourns, Inc.	Riverside, California
80368	Sylvania	New York, New York
81073	Grayhill	La Grange, Illinois
82104	Standard Grigsby	Aurora, Illinois
83330	H.H. Smith	Brooklyn, New York
84171	Arco	Great Neck, New York
86684	RCA	Harrison, New Jersey
87034	Marco-Oak	Anaheim, California
88245	Useco	Van Nuys, California
90201	Mallory	Indianapolis, Indiana
91637	Dale	Columbus, Nebraska
91662	Elco	Willow Grove, Pennsylvania
92219	Waldom	Chicago, Illinois
94222	Southco	Chester, Pennsylvania
95566	Arnold Eng.	Orange, California
99800	Delevan Electric Corp.	Aurora, New York

Table 6-1. Model PS950 Assemblies		
Table	Assembly Number	Assembly
6-3	9505001	Vertical Input Sub-Assy
6-4	9505002	Vertical Signal Assy
6-5	9505003	Vertical Interconnect Sub-Assy
6-6	9505004	Vertical Output Sub-Assy
6-7	9505005	Vertical Input Assy
6-8	9505006	Interconnect Sub-Assy
6-9	9505007	Main Chassis Assy
6-10	9505008	Final Assy
6-11	9355006	Constant Current Sub-Assy
6-12	9355007	Power Supply Assy
6-13	9355008	Horizontal Assy
6-14	9355009	CRT Control Sub-Assy
6-15	9355025	High Voltage Sub-Assy
6-16	9355027	Horizontal Sub-Assy
6-17	9355019	Power Supply Batt Pack Assy
6-18	9355020	Battery Pack Option Assy
6-19	9355021	Final Assy Batt Pack
6-20	9355024	PS935-CRT Telefunken
6-21	9405070	Handle Assy

Table 6-2. Model 975 Assemblies		
Table	Assembly Number	Assembly
6-22	9755001	DMM-Counter Sub-Assy
6-23	9755011	DMM-Counter Chassis Assy

Table 6-3. Parts List (Vertical Input Sub-Assy 9505001)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
	9503001	Etched Circuit Board	34160	1-20106
		CAPACITORS		
C1	BA2E104K	MM,.1uf±10%,400V	27556	6-59104
C2	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C3	1802Z5U050A104Z	MONO CER,.1uf+80-20%,50V	Varadyne	6-36104
C4	1802Z5U050A104Z	MONO CER,.1uf+80-20%,50V	Varadyne	6-36104
C5*	DM15-050D	DM,5Pf±.5Pf,500V	04062	6-19050
C6	538-011,D,9-35Pf	VAR,CER,9-35PF	Erie	6-96007
C7	538-011,A,2-8Pf	VAR,CER,2-8Pf	Erie	6-96002
C8	538-011,D,3-15Pf	VAR,CER,3-15Pf	Erie	6-96006
C9	538-011,A,2-8Pf	VAR,CER,2-8Pf	Erie	6-96002
C10	DM15-270J	DM,27Pf±5%,500V	04062	6-19270
C11	DM15-820J	DM,82Pf±5%,500V	04062	6-19820
C12	DM15-820J	DM,82Pf±5%,500V	04062	6-19820
C13	DM15-820J	DM,82Pf±5%,500V	04062	6-19820
C14	DM15-820J	DM,82Pf±5%,500V	04062	6-19820
C15	538-011,D,3-15Pf	VAR,CER,3-15Pf	Erie	6-96006
C16	538-011,A,2-8Pf	VAR,CER,2-8Pf	Erie	6-96002
C17	DM15-270J	DM,27Pf±5%,500V	04062	6-19270
C18	5HK-D50	CD,.005uf,1KV	56289	6-29502
C19	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C20	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C21	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C22	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C23	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C24	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C25	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C26	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C27	T392F107M016AS	TANT,100uf±20%,16V	05397	6-73107
C28	1802Z5U050A104Z	MONO CER,.1uf+80-20%,50V	Varadyne	6-36104
C29	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C30	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C31	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C32	T392F107M016AS	TANT,100uf±20%,16V	05397	6-73107
C33	1802Z5U050A104Z	MONO CER,.1uf+80-20%,50V	Varadyne	6-36104
C34	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C35	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C36	-	TBD	-	-
C37	DMM-103	CD,.01uf+60-40%,150V	71590	6-27103
C38	BA2E104K	MM,.1uf±10%,400V	27556	6-59104
C39	538-011,D,3-15Pf	VAR,CER,3-15Pf	Erie	6-96006
C40	538-011,D,9-35Pf	VAR,CER,9-35Pf	Erie	6-96007
C41	538-011,A,2-8Pf	VAR,CER,2-8Pf	Erie	6-96002

* Not used with 975

Table 6-3. Parts List (Vertical Input Sub-Assy 9505001) (Continued)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
C42	538-011,D,3-15Pf	VAR,CER,3-15Pf	Erie	6-96006
C43	538-011,A,2-8Pf	VAR,CER,2-8Pf	Erie	6-96002
C44	DM15-270J	DM,27Pf±5%,500V	04062	6-19270
C45	DM15-820J	DM,82Pf±5%,500V	04062	6-19820
C46	DM15-820J	DM,82Pf±5%,500V	04062	6-19820
C47	DM15-820J	DM,82Pf±5%,500V	04062	6-19820
C48	DM15-820J	DM,82Pf±5%,500V	04062	6-19820
C49	538,011,D,3-15Pf	VAR,CER,3-15Pf	Erie	6-96006
C50	538-011,A,2-8Pf	VAR,CER,2-8Pf	Erie	6-96002
C51	DM15-270J	DM,27Pf±5%,500V	04062	6-19270
C52	5HK-D50	CD,.005uf,1Kv	56289	6-29502
C53	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C54	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C55	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C56	DMM-103	CD,.01uf+60-40%,150V	71590	6-27103
C57	DMM-103	CD,.01uf+60-40%,150V	71590	6-27103
C58	DMM-103	CD,.01uf+60-40%,150V	71590	6-27103
C59	DMM-103	CD,.01uf+60-40%,150V	71590	6-27103
C60	DMM-103	CD,.01uf+60-40%,150V	71590	6-27103
C61	1802Z5U050A104Z	MONO CER,.1uf+80-20%,50V	Varadyne	6-36104
C62	T392F107M016AS	TANT,100uf±20%,16V	05397	6-73107
C63	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C64	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C65	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C66	T392F107M016AS	TANT,100uf±20%,16V	05397	6-73107
C67	1802Z5U050A104Z	MONO CER,.1uf+80-20%,50V	Varadyne	6-36104
C68	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C69	-	TBD	-	-
C70	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C71	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C72 *	DM15-100J	DM,10Pf±5%,500V	04062	6-19100
		DIODE		
CR1	IN914	GP, Signal	07263	3-10914
CR2	FD300	Low Leakage	07263	3-10300
CR3	FD300	Low Leakage	07263	3-10300
CR4	IN914	GP, Signal	07263	3-10914
CR5	IN914	GP, Signal	07263	3-10914
CR6	FD300	Low Leakage	07263	3-10300
CR7	FD300	Low Leakage	07263	3-10300
CR8	IN914	GP, Signal	07263	3-10914

*Used with 975

Table 6-3. Parts List (Vertical Input Sub-Assy 9505001) (Continued)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
	TEK 151-1090-02	INTEGRATED CIRCUIT		
U1	FD1846	FET, DUAL, NCH	Solitron	3-21846
U2	MPQ3904	QUAD, TRAN ARRAY	04713	3-33904
U3	MPQ3906	QUAD, TRAN ARRAY	04713	3-33906
U4	FD1846	FET, DUAL, NCH	Solitron	3-21846
U5	MPQ3904	QUAD, TRAN ARRAY	04713	3-33904
U6	MPQ3906	QUAD, TRAN ARRAY	04713	3-33906
L1-L10	FB-43-101	Ferrite Bead	Amidon	5-90001
		RESISTORS		
R1	RCR07G4R7JR	CC,4.7ohm,1/4W,5%	01121	5-10047
R2	RCR07G100JR	CC,10ohm,1/4W,5%	01121	5-10100
R3*	RCR07G106JR	CC,10Mohm,1/4W,5%	01121	5-10106
R4	RCR07G4R7JR	CC,4.7ohm,1/4W,5%	01121	5-10047
R5	RCR07G4R7JR	cc,4.7ohm,1/4W,5%	01121	5-10047
R6	RN65D1104F	Mf,1.1Mohm,1/4W,1%	91637	5-52494
R7	RN55D1132F	MF,11.3Kohm,1/8W,1%	91637	5-51304
R8	RCR07G100JR	CC,10ohm,1/4W,5%	01121	5-10100
R9	RN60D1004F	MF,1.0Mohm,1/8W,1%	91637	5-50490
R10	RN55D1243F	MF,124Kohm,1/8W,1%	91637	5-51403
R11	RCR07G4R7JR	CC,4.7ohm,1/4W,5%	01121	5-10047
R12	RCR07G4R7JR	CC,4.7ohm,1/4W,5%	01121	5-10047
R13	RCR07G100JR	CC,10ohm,1/4W,5%	01121	5-10100
R14	RN60D1004F	MF,1.0Mohm,1/8W,1%	91637	5-50490
R15	RN55D1243F	MF,124Kohm,1/8W,1%	91637	5-51403
R16	RCR07G4R7JR	CC,4.7ohm,1/4W,5%	01121	5-10047
R17	RCR07G100JR	CC,10ohm,1/4W,5%	01121	5-10100
R18	RN65D1104F	MF,1.1Mohm,1/4W,1%	91637	5-52494
R19	RCR07G822JR	CC,8.2Kohm,1/4W,5%	01121	5-10822
R20	RCR07G474JR	CC,470Kohm,1/4W,5%	01121	5-10474
R21	RCR07G105JR	CC,1Mohm,1/4W,5%	01121	5-10105
R22	RCR07G822JR	CC,8.2Kohm,1/4W,5%	01121	5-10822
R23	RCR07G100JR	CC,10ohm,1/4W,5%	01121	5-10100
R24	RN55D49R9F	MF,49.9ohm,1/8W,1%	91637	5-51067
R25	RN55D49R9F	MF,49.9ohm,1/8W,1%	91637	5-51067
R26	RCR07G100JR	CC,10ohm,1/4W,5%	01121	5-10100
R27	RCR07G222JR	CC,2.2Kohm,1/4W,5%	01121	5-10222
R28	RCR07G100JR	CC,10ohm,1/4W,5%	01121	5-10100
R29	RCR07G432JR	CC,4.3Kohm,1/4W,5%	01121	5-10432
R30	RN55D95R3F	MF,95.3ohm,1/8W,1%	91637	5-51094
R31	RN55D200DF	MF,200ohm,1/8W,1%	91637	5-51125
R32	RN55D1000F	MF,100ohm,1/8W,1%	91637	5-51096

* Not used with 975

Table 6-3. Parts List (Vertical Input Sub-Assy 9505001) (Continued)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
R33	RN55D24R9F	MF,24.9ohm,1/8W,1%	91637	5-51038
R34	RN55D1000F	MF,100ohm,1/8W,1%	91637	5-51096
R35	RN55D59R0F	MF,59.0ohm,1/8W,1%	91637	5-51074
R36	RN55D59R0F	MF,59.0ohm,1/8W,1%	91637	5-51074
R37	RCR07G100JR	CC,10ohm,1/4W,5%	01121	5-10100
R38	RN55D1000F	MF,100ohm,1/8W,1%	91637	5-51096
R39	RCR07G222JR	CC,2.2Kohm,1/4W,5%	01121	5-10222
R40	RN55D1000F	MF,100ohm,1/8W,1%	91637	5-51096
R41	RCR07G100JR	CC,10ohm,1/4W,5%	01121	5-10100
R42	RCR07G432JR	CC,4.3Kohm,1/4W,5%	01121	5-10432
R43	RN55D8251F	MF,825Kohm,1/8W,1%	91637	5-51291
R44	360T203B	VAR, CER, 20K	71590	5-73203
R45	RCR07G682JR	CC,6.8Kohm,1/4W,5%	01121	5-10682
R46	RN55D2100F	MF,210ohm,1/8W,1%	91637	5-51127
R47	RN55D4420F	MF,442ohm,1/8W,1%	91637	5-51158
R48	RN55D2100F	MF,210ohm,1/8W,1%	91637	5-51127
R49	RCR07G391JR	CC,390ohm,1/4W,5%	01121	5-10391
R50	RCR07G122JR	CC,1.2Kohm,1/4W,5%	01121	5-10122
R51	RCR07G391JR	CC,390ohm,1/4W,5%	01121	5-10391
R52	RN55D63R4F	MF,63.4ohm,1/8W,1%	91637	5-51077
R53	RN55D63R4F	MF,63.4ohm,1/8W,1%	91637	5-51077
R54	RN55D9531F	MF,9.53Kohm,1/8W,1%	91637	5-51297
R55	RN55D2801F	MF,2.80Kohm,1/8W,1%	91637	5-51236
R56	RN55D1740F	MF,174ohm,1/8W,1%	91637	5-51119
R57	RN55D2801F	MF,2.80Kohm,1/8W,1%	91637	5-51236
R58	RN55D1650F	MF,165ohm,1/8W,1%	91637	5-51117
R59	RN55D9531F	MF,9.53Kohm,1/8W,1%	91637	5-51297
R60	RN55D63R4F	MF,63.4ohm,1/8W,1%	91637	5-51077
R61	RN55D63R4F	MF,63.4ohm,1/8W,1%	91637	5-51077
R62	RCR07G621JR	CC,620ohm,1/4W,1%	01121	5-10621
R63	-	TBD	-	-
R64	RCR07G621JR	CC,620ohm,1/4W,5%	01121	5-10621
R65	RCR07G4R7JR	CC,4.7ohm,1/4W,5%	01121	5-10047
R66	RCR07G100JR	CC,10ohm,1/4W,5%	01121	5-10100
R67	RCR07G106JR	CC,10Mohm,1/4W,5%	01121	5-10106
R68	RCR07G4R7JR	CC,4.7ohm,1/4W,5%	01121	5-10047
R69	RCR07G4R7JR	CC,4.7ohm,1/4W,5%	01121	5-10047
R70	RN65D1104F	MF,1.1Mohm,1/4W,1%	91637	5-52494
R71	RN55D1132F	MF,11.3Kohm,1/8W,1%	91637	5-51304
R72	RCR07G100JR	CC,10ohm,1/4W,5%	01121	5-10100
R73	RN60D1004F	MF,1.0Mohm,1/8W,1%	91637	5-50490
R74	RN55D1243F	MF,124Kohm,1/8W,1%	91637	5-51403
R75	RCR07G4R7JR	CC,4.7ohm,1/4W,5%	01121	5-10047
R76	RCR07G4R7JR	CC,4.7ohm,1/4W,5%	01121	5-10047

Table 6-3. Parts List (Vertical Input Sub-Assy 9505001) (Continued)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
R77	RCR07G100JR	CC,10ohm,1/4W,5%	01121	5-10100
R78	RN60D1004F	MF,1.0Mohm,1/8W,1%	91637	5-50490
R79	RN55D1243F	MF,124Kohm,1/8W,1%	91637	5-51403
R80	RCR07G4R7JR	CC,4.7ohm,1/4W,5%	01121	5-10047
R81	RCR07G100JR	CC,10ohm,1/4W,5%	01121	5-10100
R82	RN65D1104F	MF,1.1Mohm,1/4W,1%	91637	5-52494
R83	RCR07G822JR	CC,8.2Kohm,1/4W,5%	01121	5-10822
R84	RCR07G474JR	CC,470Kohm,1/4W,5%	01121	5-10474
R85	RCR07G105JR	CC,1Mohm,1/4W,5%	01121	5-10105
R86	RCR07G822JR	CC,8.2Kohm,1/4W,5%	01121	5-10822
R87	RCR07G100JR	CC,10ohm,1/4W,5%	01121	5-10100
R88	RN55D49R9F	MF,49.9ohm,1/8W,1%	91637	5-51067
R89	RN55D49R9F	MF,49.9ohm,1/8W,1%	91637	5-51067
R90	RCR07G100JR	CC,10ohm,1/4W,5%	01121	5-10100
R91	RCR07G222JR	CC,2.2Kohm,1/4W,5%	01121	5-10222
R92	RCR07G100JR	CC,10ohm,1/4W,5%	01121	5-10100
R93	RCR07G432JR	CC,4.3Kohm,1/4W,5%	01121	5-10432
R94	RN55D95R3F	MF,95.3ohm,1/8W,1%	91637	5-51094
R95	RN55D200DF	MF,200ohm,1/8W,1%	91637	5-51125
R96	RN55D1000F	MF,100ohm,1/8W,1%	91637	5-51096
R97	RN55D24R9F	MF,24.9ohm,1/8W,1%	91637	5-51038
R98	RN55D1000F	MF,100ohm,1/8W,1%	91637	5-51096
R99	RN55D41R2F	MF,59.0ohm,1/8W,1%	91637	5-51074
R100	RN55D41R2F	MF,59.0ohm,1/8W,1%	91637	5-51074
R101	RCR07G100JR	CC,10ohm,1/4W,5%	01121	5-10100
R102	RN55D1000F	MF,100ohm,1/8W,1%	91637	5-51096
R103	RCR07G222JR	CC,2.2Kohm,1/4W,5%	01121	5-10222
R104	RN55D1000F	MF,100ohm,1/8W,1%	91637	5-51096
R105	RCR07G100JR	CC,10ohm,1/4W,5%	01121	5-10100
R106	RCR07G432JR	CC,4.3Kohm,1/4W,5%	01121	5-10432
R107	RN55D8251F	MF,8.25Kohm,1/8W,1%	91637	5-51291
R108	360T203B	VAR, CER, 20K	71590	5-73203
R109	RCR07G682JR	CC,6.8Kohm,1/4W,5%	01121	5-10682
R110	RN55D2100F	MF,210ohm,1/8W,1%	91637	5-51127
R111	RN55D4420F	MF,442ohm,1/8W,1%	91637	5-51158
R112	RN55D2100F	MF,210ohm,1/8W,1%	91637	5-51127
R113	RCR07G391JR	CC,390ohm,1/4W,5%	01121	5-10391
R114	RCR07G122JR	CC,1.2Kohm,1/4W,5%	01121	5-10122
R115	RCR07G391JR	CC,390ohm,1/4W,5%	01121	5-10391
R116	RN55D63R4F	MF,63.4ohm,1/8W,1%	91637	5-51077
R117	RN55D63R4F	MF,63.4ohm,1/8W,1%	91637	5-51077
R118	RN55D9531F	MF,9.53Kohm,1/8W,1%	91637	5-51297
R119	RN55D2801F	MF,2.80Kohm,1/8W,1%	91637	5-51236
R120	RN55D1740F	MF,174ohm,1/8W,1%	91637	5-51119
R121	RN55D2801F	MF,2.80Kohm,1/8W,1%	91637	5-51236

Table 6-3. Parts List (Vertical Input Sub-Assy 9505001) (Continued)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
R122	RN55D1650F	MF,165ohm,1/8W,1%	91637	5-51117
R123	RN55D9531F	MF,9.53Kohm,1/8W,1%	91637	5-51297
R124	RN55D63R4F	MF,63.4ohm,1/8W,1%	91637	5-51077
R125	RN55D63R4F	MF,63.4ohm,1/8W,1%	91637	5-51077
R126	RCR07G561JR	CC,560ohm,1/4W,5%	01121	5-10561
R127	-	TBD	-	-
R128	RCR07G561JR	CC,560ohm,1/4W,5%	01121	5-10561
R129	RCR07G103JR	CC,10Kohm,1/4W,5%	01121	5-10103
R130	RCR07G103JR	CC,10Kohm,1/4W,5%	01121	5-10103
R131	RCR07G103JR	CC,10Kohm,1/4W,5%	01121	5-10103
R132	RCR07G103JR	CC,10Kohm,1/4W,5%	01121	5-10103
R133, S3	2432001-4	Mod Pot, 2.5Kohm, W/3001	01121	5-79252
R134, S6	2342001-4	Mod Pot, 2.5Kohm, W/3001	01121	5-79252
R135	360T502B	VAR, CER, 5Kohm	71590	5-73502
R136	360T502B	VAR, CER, 5Kohm	71590	5-73502
		SWITCHES		
S1	9152003	Input Coupling Switch	34160	2-10047
S2	9352002	Vert Sensitivity Switch	34160	2-10051
S3	-	Reference to R133	-	-
S4	9152003	Input Coupling Switch	34160	2-10047
S5	9352002	Vert Sensitivity Switch	34160	2-10051
S6	-	Reference to R134	-	-
	SD-5176-8	I.C. Socket TO5	Robinson Nuget	2-60012
	CDH-4000-14	I.C. Socket 14 Pin	SAE	2-60013
		TRANSISTORS		
Q1	2N5179	NPN, Silicon	04713	3-25179
Q2	2N5179	NPN, Silicon	04713	3-25179
Q3	2432016-1	NPN, Silicon } Matched Set	34160	3-25180
Q4	-	NPN, Silicon } 2N5179	-	-
Q5	2N3904	NPN, Signal	07263	3-23904
Q6	2N5179	NPN, Silicon	07263	3-25179
Q7	2N5179	NPN, Silicon	07263	3-25179
Q8	2432016-1	NPN, Silicon } Matched Set	34160	3-25180
Q9	-	NPN, Silicon } 2N5179	-	-
Q10	2N3904	NPN, Signal	07263	3-23904
2 Req.	TXBF019-025B	Heatsink, TO18	IERC	3-90003
2 Req.	259-18-25	Heatsink, TO18 Dual	Wakefield	3-90005
	MP165-2	Mini-pin .3L	PMP	2-24016

Table 6-3. Parts List (Vertical Input Sub-Assy 9505001) (Continued)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
		HARDWARE		
2 Req.	9352005	Shield, Vertical Input	34160	1-10770
2 Req.	9352040	Shaft, Vert Vernier	34160	1-10805
2 Req.	5B-250-2	Heyco Bushing	Heyco	2-45006
2 Req.	9402084	Shaft, Coupler	34160	1-10699
16 Req.	MS51957-3	Screw, 2-56 X 1/4 Panhead	-	8-10003
16 Req.	MS35333-69	Washer, #2 Int. Lk.	-	8-40001
	9352029	Bracket, P.S. Support	34160	1-10778
	MS51957-13	Screw, 4-40 X 1/4 Panhead	-	8-10013
	NAS671C4	Nut, 4-40	-	8-30005
	MS3533-70	Washer, #4 Int. Lk.	-	8-40002

Table 6-4. Parts List (Vertical Signal Assy 9505002)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
	9503002	Etched Circuit Board	34160	1-20107
		CAPACITORS		
C1	T392F107M016AS	TANT,100uf±20%,16V	05397	6-73107
C2	2130Z5U100R104ZC	MONO CER,.1uf+80-20%,100V	Varadyne	6-37104
C3	T392F107M016AS	TANT,100uf±20%,16V	05397	6-73107
C4	2130Z5U100R104ZC	MONO CER,.1uf+80-20%,100V	Varadyne	6-37104
C5	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C6	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C7	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C8	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C9	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C10	-	TBD	-	-
C11	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C12	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C13	-	TBD	-	-
C14	-	TBD	-	-
C15	DM15-050D	DM,5Pf±.5Pf,500V	04062	6-19050
C16	DM15-050D	DM,5Pf±.5Pf,500V	04062	6-19050
C17	DM15-220J	DM,22Pf±5%,500V	04062	6-19220
C18	DM15-220J	DM,22Pf±5%,500V	04062	6-19220
C19	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C20	T392F107M016AS	TANT,100uf±20%,16V	05397	6-73107
C21	2130Z5U100R104ZC	MONO CER,.1uf+80-20%,100V	Varadyne	6-37104
C22	-	TBD (1Pf)	-	-
C23	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C24	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C25	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C26	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C27	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C28	-	TBD (1Pf)	-	-
C29	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C30	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C31	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C32	-	TBD	-	-
C33	-	TBD	-	-
C34	2130Z5U100R104ZC	MONO CER,.1uf+80-20%,100V	Varadyne	6-37104
C35	T392F107M016AS	TANT, 100uf±20%,16V	05397	6-73107
C36	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C37	DM15-470J	DM,47Pf±5%,500V	04062	6-19470
C38	DM15-821J	DM,820Pf±5%,500V	04062	6-19821
		DIODES		
CR1	1N914	GP, Signal	07263	3-10914

-N Indicates Nominal Value

Table 6-4. Parts List (Vertical Signal Assy 9505002) (Continued)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
CR2	1N914	GP, Signal	07263	3-10914
CR3	1N914	GP, Signal	07263	3-10914
CR4	1N914	GP, Signal	07263	3-10914
CR5	1N914	GP, Signal	07263	3-10914
CR6	1N914	GP, Signal	07263	3-10914
CR7	1N914	GP, Signal	07263	3-10914
CR8	1N914	GP, Signal	07263	3-10914
CR9	1N914	GP, Signal	07263	3-10914
CR10	1N914	GP, Signal	07263	3-10914
CR11	1N914	GP, Signal	07263	3-10914
CR12	1N914	GP, Signal	07263	3-10914
CR13	1N914	GP, Signal	07263	3-10914
CR14	1N914	GP, Signal	07263	3-10914
CR15	1N914	GP, Signal	07263	3-10914
CR16	1N914	GP, Signal	07263	3-10914
CR17	1N914	GP, Signal	07263	3-10914
CR18	1N914	GP, Signal	07263	3-10914
CR19	1N914	GP, Signal	07263	3-10914
CR20	1N914	GP, Signal	07263	3-10914
CR21	1N914	GP, Signal	07263	3-10914
CR22	1N914	GP, Signal	07263	3-10914
		RESISTORS		
R1	RCR07G561JR	CC,560ohm,1/4W,5%	01121	5-10561
R2	RN55D1151F	MF,1.15Kohm,1/8W,1%	91637	5-51199
R3	RN55D3010F	MF,301ohm,1/8W,1%	91637	5-51142
R4	RN55D5620F	MF,562ohm,1/8W,1%	91637	5-51168
R5	360T501B	VAR, CER, 500ohm	71450	5-73501
R6	RN55D3010F	MF,301ohm,1/8W,1%	91637	5-51142
R7	RCR07G682JR	CC,6.8Kohm,1/4W,5%	01121	5-10682
R8	RN55D51R1F	MF,51.1ohm,1/8W,1%	91637	5-51068
R9	360T501B	VAR, CER, 500ohm	71450	5-73501
R10	RN55D1500F	MF,150ohm,1/8W,1%	91637	5-51113
R11	RCR07G122JR	CC,1.2Kohm,1/4W,5%	01121	5-10122
R12	RN55D51R1F	MF,51.1ohm,1/8W,1%	91637	5-51068
R13	RN55D1691F	MF,1.69Kohm,1/8W,1%	91637	5-51215
R14	RN55D6981F	MF,6.98Kohm,1/8W,1%	91637	5-51284
R15	RCR07G332JR	CC,3.3Kohm,1/4W,5%	01121	5-10332
R16	RCR07G823JR	CC,82Kohm,1/4W,5%	01121	5-10823
R17	RN55D2871F	MF,2.87Kohm,1/8W,1%	91637	5-51237
R18	RN55D9761F	MF,9.76Kohm,1/8W,1%	91637	5-51298
R19	RN55D1650F	MF,165ohm,1/8W,1%	91637	5-51117
R20	RV6NAYSD252B	VAR, CARB, 2.5Kohm	01121	5-76252
R21	RN55D6190F	MF,619ohm,1/8W,1%	91637	5-51172

Table 6-4. Parts List (Vertical Signal Assy 9505002) (Continued)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
R22	RCR07G752JR	CC,7.5Kohm,1/4W,5%	01121	5-10752
R23	RN55D6190F	MF,619ohm,1/8W,1%	91637	5-51172
R24	RCR07G752JR	CC,7.5Kohm,1/4W,5%	01121	5-10752
R25	RN55D2100F	MF,210ohm,1/8W,1%	91637	5-51127
R26	RCR07G391JR	CC,390ohm,1/4W,5%	01121	5-10391
R27	RN55D2000F	MF,200ohm,1/8W,1%	91637	5-51125
R28	RN55D5620F	MF,562ohm,1/8W,1%	91637	5-51168
R29	RCR07G122JR	CC,1.2Kohm,1/4W,5%	01121	5-10122
R30	RCR07G620JR	CC,62ohm,1/4W,5%	01121	5-10620
R31	RN55D1910F	MF,191ohm,1/8W,1%	91637	5-51123
R32	RN55D3401F	MF,3.40Kohm,1/8W,1%	91637	5-51244
R33	RN55D1182F	MF,11.8Kohm,1/8W,1%	91637	5-51306
R34	RN55D2100F	MF,210ohm,1/8W,1%	91637	5-51127
R35	RCR07G391JR	CC,390ohm,1/4W,5%	01121	5-10391
R36	RN55D2000F	MF,200ohm,1/8W,1%	91637	5-51125
R37	RCR07G822JR	CC,8.2Kohm,1/4W,5%	01121	5-10822
R38	RN55D2871F	MF,2.87Kohm,1/8W,1%	91637	5-51237
R39	RCR07G104JR	CC,100Kohm,1/4W,5%	01121	5-10104
R40	RN55D1690F	MF,169ohm,1/8W,1%	91637	5-51118
R41	RCR07G561JR	CC,560ohm,1/4W,5%	01121	5-10561
R42	RN55D9761F	MF,9.76Kohm,1/8W,1%	91637	5-51298
R43	RCR07G201JR	CC,200ohm,1/4W,5%	01121	5-10201
R44	RN55D95R3F	MF,95.3ohm,1/8W,1%	91637	5-51094
R45	RN55D95R3F	MF,95.3ohm,1/8W,1%	91637	5-51094
R46	RCR07G471JR	CC,470ohm,1/4W,5%	01121	5-10471
R47	RCR07G820JR	CC,82ohm,1/4W,5%	01121	5-10820
R48	RCR07G820JR	CC,82ohm,1/4W,5%	01121	5-10820
R49	RCR07G471JR	CC,470ohm,1/4W,5%	01121	5-10471
R50	RCR07G683JR	CC,68Kohm,1/4W,5%	01121	5-10683
R51	RCR07G683JR	CC,68Kohm,1/4W,5%	01121	5-10683
R52	RCR07G822JR	CC,8.2Kohm,1/4W,5%	01121	5-10822
R53	RCR07G681JR	CC,680ohm,1/4W,5%	01121	5-10681
R54	RCR07G822JR	CC,8.2Kohm,1/4W,5%	01121	5-10822
R55	RCR07G681JR	CC,680ohm,1/4W,5%	01121	5-10681
R56	RCR07G104JR	CC,100Kohm,1/4W,5%	01121	5-10104
R57	RCR07G163JR	CC,16Kohm,1/4W,5%	01121	5-10163
R58	RCR07G473JR	CC,47Kohm,1/4W,5%	01121	5-10473
R59	RCR07G822JR	CC,8.2Kohm,1/4W,5%	01121	5-10822
R60	RCR07G822JR	CC,8.2Kohm,1/4W,5%	01121	5-10822
R61	RCR07G473JR	CC,47Kohm,1/4W,5%	01121	5-10473
R62	RCR07G163JR	CC,16Kohm,1/4W,5%	01121	5-10163
R63	RCR07G103JR	CC,10Kohm,1/4W,5%	01121	5-10103
R64	RCR07G242JR	CC,2.4Kohm,1/4W,5%	01121	5-10242
R65	RCR07G473JR	CC,47Kohm,1/4W,5%	01121	5-10473
R66	RCR07G562JR	CC,5.6Kohm,1/4W,5%	01121	5-10562

Table 6-4. Parts List (Vertical Signal Assy 9505002) (Continued)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
R67	RCR07G223JR	CC,22Kohm,1/4W,5%	01121	5-10223
R68	RCR07G473JR	CC,47Kohm,1/4W,5%	01121	5-10473
R69	RCR07G562JR	CC,5.6Kohm,1/4W,5%	01121	5-10562
R70	RCR07G223JR	CC,22Kohm,1/4W,5%	01121	5-10223
R71	RCR07G242JR	CC,2.4Kohm,1/4W,5%	01121	5-10242
R72	RN55D2100F	MF,210ohm,1/8W,1%	91637	5-51127
R73	RCR07G510JR	CC,51ohm,1/4W,5%	01121	5-10510
R74	RCR07G510JR	CC,51ohm,1/4W,5%	01121	5-10510
R75	RCR07G681JR	CC,680ohm,1/4W,5%	01121	5-10681
R76	RCR07G681JR	CC,680ohm,1/4W,5%	01121	5-10681
R77	RN55D5620F	MF,562ohm,1/8W,1%	91637	5-51168
R78	RCR07G510JR	CC,51ohm,1/4W,5%	01121	5-10510
R79	RCR07G510JR	CC,51ohm,1/4W,5%	01121	5-10510
R80	RN55D2100F	MF,210ohm,1/8W,1%	91637	5-51127
R81	RCR07G682JR	CC,6.8Kohm,1/4W,5%	01121	5-10682
R82	RN55D51R1F	MF,51.1ohm,1/8W,1%	91637	5-51068
R83	RCR07G122JR	CC,1.2Kohm,1/4W,5%	01121	5-10122
R84	360T501B	VAR, CER, 500ohm	71450	5-73501
R85	RN55D1500F	MF,150ohm,1/8W,1%	91637	5-51113
R86	RN55D51R1F	MF,51.1ohm,1/8W,1%	91637	5-51068
R87	RN55D1691F	MF,1.69Kohm,1/8W,1%	91637	5-51215
R88	RN55D6981F	MF,6.98Kohm,1/8W,1%	91637	5-51284
R89	RCR07G332JR	CC,3.3Kohm,1/4W,5%	01121	5-10332
R90	RCR07G823JR	CC,82Kohm,1/4W,5%	01121	5-10823
R91	RN55D1650F	MF,165ohm,1/8W,1%	91637	5-51117
R92	RN55D2871F	MF,2.87Kohm,1/8W,1%	91637	5-51237
R93	RN55D9761F	MF,9.76Kohm,1/8W,1%	91637	5-51298
R94	RN55D6190F	MF,619ohm,1/8W,1%	91637	5-51172
R95	RV6NAYSD252B	VAR, CARB, 2.5Kohm	01121	5-76252
R96	RN55D6190F	MF,619ohm,1/8W,1%	91637	5-51172
R97	RCR07G752JR	CC,7.5Kohm,1/4W,5%	01121	5-10752
R98	RCR07G752JR	CC,7.5Kohm,1/4W,5%	01121	5-10752
R99	RN55D2100F	MF,210ohm,1/8W,1%	91637	5-51127
R100	RCR07G511JR	CC,510ohm,1/4W,5%	01121	5-10511
R101	RN55D2000F	MF,200ohm,1/8W,1%	91637	5-51125
R102	RCR07G152JR	CC,1.5Kohm,1/4W,5%	01121	5-10152
R103	RCR07G620JR	CC,62ohm,1/4W,5%	01121	5-10620
R104	RN55D1910F	MF,191ohm,1/8W,1%	91637	5-51123
R105	RN55D3401F	MF,3.40Kohm,1/8W,1%	91637	5-51244
R106	RN55D5620F	MF,562ohm,1/8W,1%	91637	5-51168
R107	RCR07G822JR	CC,8.2Kohm,1/4W,5%	01121	5-10822
R108	RN55D1182F	MF,11.8Kohm,1/8W,1%	91637	5-51306
R109	RN55D2100F	MF,210ohm,1/8W,1%	91637	5-51127
R110	RCR07G511JR	CC,510ohm,1/4W,5%	01121	5-10511
R111	RN55D2000F	MF,200ohm,1/8W,1%	91637	5-51125

Table 6-4. Parts List (Vertical Signal Assy 9505002) (Continued)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
R112	RCR07G153JR	CC,15Kohm,1/4W,5%	01121	5-10153
R113	RCR07G472JR	CC,4.7Kohm,1/4W,5%	01121	5-10472
R114	RCR07G272JR	CC,2.7Kohm,1/4W,5%	01121	5-10272
R115	RCR07G510JR	CC,51ohm,1/4W,5%	01121	5-10510
R116	RCR07G152JR	CC,1.5Kohm,1/4W,5%	01121	5-10152
R117	RN55D2100F	MF,210ohm,1/8W,1%	91637	5-51127
R118	RN55D2100F	MF,210ohm,1/8W,1%	91637	5-51127
R119	RN55D5620F	MF,562ohm,1/8W,1%	91637	5-51168
R120	RCR07G822JR	CC,8.2Kohm,1/4W,5%	01121	5-10822
R121	RCR07G272JR	CC,2.7Kohm,1/4W,5%	01121	5-10272
R122	RCR07G510JR	CC,51ohm,1/4W,5%	01121	5-10510
R123	RCR07G683JR	CC,68Kohm,1/4W,5%	01121	5-10683
R124	RCR07G683JR	CC,68Kohm,1/4W,5%	01121	5-10683
R125	RN55D9761F	MF,9.76Kohm,1/8W,1%	91637	5-51298
R126	RN55D2871F	MF,2.87Kohm,1/8W,1%	91637	5-51237
R127	RN55D1690F	MF,169ohm,1/8W,1%	91637	5-51118
R128	RCR07G561JR	CC,560ohm,1/4W,5%	01121	5-10561
R129	RCR07G201JR	CC,200ohm,1/4W,5%	01121	5-10201
R130	RN55D95R3F	MF,95.3ohm,1/8W,1%	91637	5-51094
R131	RN55D95R3F	MF,95.3ohm,1/8W,1%	91637	5-51094
R132	RCR07G331JR	CC,330ohm,1/4W,5%	01121	5-10331
R133	RCR07G820JR	CC,82ohm,1/4W,5%	01121	5-10820
R134	RCR07G820JR	CC,82ohm,1/4W,5%	01121	5-10820
R135	RCR07G331JR	CC,330ohm,1/4W,5%	01121	5-10331
R136	RCR07G822JR	CC,8.2Kohm,1/4W,5%	01121	5-10822
R137	RN55D1241F	MF,1.24Kohm,1/8W,1%	91637	5-51202
R138	RCR07G682JR	CC,6.8Kohm,1/4W,5%	01121	5-10682
R139	RCR07G682JR	CC,6.8Kohm,1/4W,5%	01121	5-10682
R140	RCR07G181JR	CC,180ohm,1/4W,5%	01121	5-10181
R141	RCR07G181JR	CC,180ohm,1/4W,5%	01121	5-10181
R142	RN55D6650F	MF,665ohm,1/8W,1%	91637	5-51175
R143	RN55D6650F	MF,665ohm,1/8W,1%	91637	5-51175
R144	RN55D2801F	MF,2.80Kohm,1/8W,1%	91637	5-51236
R145	RN55D9531F	MF,9.53Kohm,1/8W,1%	91637	5-51297
R146	RN55D93R1F	MF,93.1ohm,1/8W,1%	91637	5-51093
		SWITCHES		
S1	9352050	Display Mode, 6 sta.	34160	2-10053
S2	9352052	Trigger Select, 3 sta.	34160	2-10052
		TRANSISTORS		
Q1	2N3906	PNP, Signal	07263	3-23906
Q2	2N3906	PNP, Signal	07263	3-23906

Table 6-4. Parts List (Vertical Signal Assy 9505002) (Continued)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
Q3	2N3906	PNP, Signal	07263	3-23906
Q4	2N3906	PNP, Signal	07263	3-23906
Q5	2N3906	PNP, Signal	07263	3-23906
Q6	2N3906	PNP, Signal	07263	3-23906
Q7	2N3904	NPN, Signal	07263	3-23904
Q8	2N3904	NPN, Signal	07263	3-23904
Q9	2N3904	NPN, Signal	07263	3-23904
Q10	2N3904	NPN, Signal	07263	3-23904
Q11	2N3904	NPN, Signal	07263	3-23904
Q12	2N3906	PNP, Signal	07263	3-23906
Q13	2N3906	PNP, Signal	07263	3-23906
Q14	2N3904	NPN, Signal	07263	3-23904
Q15	2N3904	NPN, Signal	07263	3-23904
Q16	2N3904	NPN, Signal	07263	3-23904
Q17	2N3904	NPN, Signal	07263	3-23904
Q18	2N3904	NPN, Signal	07263	3-23904
Q19	2N3904	NPN, Signal	07263	3-23904
Q20	2N3906	PNP, Signal	07263	3-23906
Q21	2N3906	PNP, Signal	07263	3-23906
Q22	2N3906	PNP, Signal	07263	3-23906
Q23	2N3906	PNP, Signal	07263	3-23906
Q24	2N3906	PNP, Signal	07263	3-23906
Q25	2N3906	PNP, Signal	07263	3-23906
Q26	2N3906	PNP, Signal	07263	3-23906
Q27	2N3904	NPN, Signal	07263	3-23904
Q28	2N3904	NPN, Signal	07263	3-23904
Q29	2N3904	NPN, Signal	07263	3-23904
Q30	2N3904	NPN, Signal	07263	3-23904
Q31	2N3904	NPN, Signal	07263	3-23904
Q32	2N3906	PNP, Signal	07263	3-23906
Q33	2N3904	NPN, Signal	07263	3-23904
Q34	2N3904	NPN, Signal	07263	3-23904
Q35	2N3904	NPN, Signal	07263	3-23904
Q36	2N3904	NPN, Signal	07263	3-23904
Q37	2N3904	NPN, Signal	07263	3-23904
Q38	2N3904	NPN, Signal	07263	3-23904
Q39	2N3904	NPN, Signal	07263	3-23904
Q40	2N3904	NPN, Signal	07263	3-23904
Q41	2N3904	NPN, Signal	07263	3-23904
Q42	2N3906	PNP, Signal	07263	3-23906
Q43	2N3906	PNP, Signal	07263	3-23906
Q44	2N3906	PNP, Signal	07263	3-23906
Q45	2N3904	NPN, Signal	07263	3-23904
Q46	2N3904	NPN, Signal	07263	3-23904

Table 6-4. Parts List (Vertical Signal Assy 9505002) (Continued)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
Q47	2N3904	NPN, Signal	07263	3-23904
Q48	2N3904	NPN, Signal	07263	3-23904
Q49	2N3904	NPN, Signal	07263	3-23904
Q50	2N3904	NPN, Signal	07263	3-23904
Q51	2N3904	NPN, Signal	07263	3-23904
Q52	2N3906	PNP, Signal	07263	3-23906
Q53	2N3906	PNP, Signal	07263	3-23906
Q54	2N3906	PNP, Signal	07263	3-23906
Q55	2N3906	PNP, Signal	07263	3-23906
Q56	2N3906	PNP, Signal	07263	3-23906
Q57	2N3906	PNP, Signal	07263	3-23906
Q58	2N3906	PNP, Signal	07263	3-23906
Q59	2N3906	PNP, Signal	07263	3-23906
Q60	2N3906	PNP, Signal	07263	3-23906
		HARDWARE		
	9502013	Bracket, Signal Bd.	34160	1-10834
	8775	Spacer 4-40 X 5/8 Thd.	83330	4-20151
9 Req.	9152030	Button	34160	1-10716
2 Req.	021-2220	Knob, Blk.	Interlok	4-10011
2 Req.	040-1020	Knob Cap, Blk.	Interlok	4-10012
2 Req.	KF2-440	Fastener, Pem	46384	4-20295
2 Req.	KFE-116-20	Fastener, Pem .625L	46384	4-20321
3 Req.	MS51957-13	Screw,4-40 X 1/4 Panhead	-	8-10013
3 Req.	MS35333-70	Washer, #4, Int. Lk.	-	8-40002
2 Req.	NAS671C4	Nut, 4-40		8-30005
2 Req.	MS24693-2	Screw,4-40X1/4 Flathead	-	8-20013

Table 6-5. Parts List (Vertical Interconnect Sub- Assy 9505003)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
	9503003	Etched Circuit Board	34160	1-20108
		CAPACITORS		
C1	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C2	T392F107M016AS	TANT,100uf±20%,16V	05397	6-73107
C3	2130Z5U100R104ZC	MONO CER,.1uf+80-20%,100V	Varadyne	6-37104
C4	2130Z5U100R104ZC	MONO CER,.1uf+80-20%,100V	Varadyne	6-37104
C5	T392F107M016AS	TANT,100uf±20%,16V	05397	6-73107
C6	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C7	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C8	538-006,F,15-60Pf	VAR, CER, 15-60Pf	Erie	6-96008
C9	DM15-330J	DM,33Pf±5%,500V	04062	6-19330
C10	DM15-101J	DM,100Pf±5%,500V	04062	6-19101
C11	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C12-N	DM15-331J	DM,330Pf±5%,500V	04062	6-19331
U1	MPQ3904	I.C. Quad Tran Array	04713	3-33904
		RESISTORS		
R1	RN55D3090F	MF,309ohm,1/8W,1%	91637	5-51143
R2	RN55D3160F	MF,316ohm,1/8W,1%	91637	5-51144
R3	360T102B	VAR,CER, 1Kohm	71450	5-73102
R4	RN55D5110F	MF,511ohm,1/8W,1%	91637	5-51164
R5	RN55D3090F	MF,309ohm,1/8W,1%	91637	5-51143
R6	RN55D2670F	MF,267ohm,1/8W,1%	91637	5-51137
R7	RCR07G153JR	CC,15Kohm,1/4W,5%	01121	5-10153
R8	RCR07G222JR	CC,2.2Kohm,1/4W,5%	01121	5-10222
R9	RCR07G123JR	CC,12Kohm,1/4W,5%	01121	5-10123
R10	RCR07G104JR	CC,100Kohm,1/4W,5%	01121	5-10104
R11-N	RCR07G101JR	CC,100ohm,1/4W,5%	01121	5-10101
R12-N	RCR07G101JR	CC,100ohm,1/4W,5%	01121	5-10101
R13	RN55D93R1F	MF,93.1ohm,1/8W,1%	91637	5-51093
R14	RCR07G680JR	CC,68ohm,1/4W,5%	01121	5-10680
R15	RN55D93R1F	MF,93.1ohm,1/8W,1%	91637	5-51093
R16	RCR07G680JR	CC,68ohm,1/4W,5%	01121	5-10680
R17	360T202B	VAR, CER, 2Kohm	71450	5-73202
R18	RN55D39R2F	MF,39.2ohm,1/8W,1%	91637	5-51057
R19	RN55D39R2F	MF,39.2ohm,1/8W,1%	91637	5-51057
R20	360T103B	VAR, CER, 10Kohm	71450	5-73103
R21	360T103B	VAR, CER, 10Kohm	71450	5-73103
R22	RN55D41R2F	MF,41.2ohm,1/8W,1%	91637	5-51059
R23	RN55D2261F	MF,2.26Kohm,1/8W,1%	91637	5-51227

-N Indicates Nominal Value

Table 6-5. Parts List (Vertical Interconnect Sub- Assy 9505003) (Continued)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
R24	RN55D6980F	MF,698ohm,1/8W,1%	91637	5-51178
		TRANSISTORS		
Q1	2N3904	NPN, Signal	04713	3-23904
Q2	2N3906	PNP, Signal	04713	3-23906
		HARDWARE		
J1	EB7D-K10GF	Connector, 10 Pin P.C.	Dale	2-24025
J2	EB7D-K10GF	Connector, 10 Pin P.C.	Dale	2-24025
DL1	2970-01-03	Terminal	Cambion	2-23998
DL2	2970-01-03	Terminal	Cambion	2-23998

Table 6-6. Parts List (Vertical Output Sub-Assy 9505004)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
	9503004b	Etched Circuit Board	34160	1-20109
	9505003	Vert Interconnect Sub-Assy	34160	-
		CAPACITORS		
C1	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C2	1802Z5U050A104Z	MONO CER,.1uf+80-20%,50V	Varadyne	6-36104
C3	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C4	T392F107M016AS	TANT,100uf±20%,16V	05397	6-73107
C5	2130Z5U100R104ZC	MONO CER,.1uf+80-20%,100V	Varadyne	6-37104
C6	T392F107M016AS	TANT,100uf±20%,16V	05397	6-73107
C7	2130Z5U100R104ZC	MONO CER,.1uf+80-20%,100V	Varadyne	6-37104
C8	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C9	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C10	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C11	1802Z5U050A104Z	MONO CER,.1uf+80-20%,50V	Varadyne	6-36104
C12	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C13	538-006,F,15-60Pf	VAR, CER, 15-60Pf	Erie	6-96008
C14	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C15	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C16	T392F107M016AS	TANT,100uf±20%,16V	05397	6-73107
C17	2130Z5U100R104ZC	MONO CER,.1uf+80-20%,150V	Varadyne	6-37104
C18	2130Z5U100R104ZC	MONO CER,.1uf+80-20%,150V	Varadyne	6-37104
C19	T392F107M016AS	TANT,100uf±20%,16V	05397	6-73107
C20	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
		CHOKES		
		CHOKES		
L1	FB-43-101	Ferrite Bead	Amidon	5-90001
L2	FB-43-101	Ferrite Bead	Amidon	5-90001
L3	FB-43-101	Ferrite Bead	Amidon	5-90001
L4	FB-43-101	Ferrite Bead	Amidon	5-90001
L5	FB-43-101	Ferrite Bead	Amidon	5-90001
L6	FB-43-101	Ferrite Bead	Amidon	5-90001
L7	FB-43-101	Ferrite Bead	Amidon	5-90001
L8	FB-43-101	Ferrite Bead	Amidon	5-90001
L9	FB-43-101	Ferrite Bead	Amidon	5-90001
L10	FB-43-101	Ferrite Bead	Amidon	5-90001
		RESISTORS		
R1	RN55D1870F	MF,187ohm,1/8W,1%	91637	5-51122
R2	RCR07G330JR	CC,33ohm,1/4W,5%	01121	5-10330
R3	RCR07G181JR	CC,180ohm,1/4W,5%	01121	5-10181

Table 6-6. Parts List (Vertical Output Sub-Assy 9505004) (Continued)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
R4	RN55D2000F	MF,200ohm,1/8W,1%	91637	5-51125
R5	RN55D7500F	MF,750ohm,1/8W,1%	91637	5-51181
R6	RN55D8252F	MF,82.5ohm,1/8W,1%	91637	5-51088
R7	RN55D2211F	MF,2.21Kohm,1/8W,1%	91637	5-51226
R8	RN55D8252F	MF,82.5ohm,1/8W,1%	91637	5-51088
R9	RN55D4750F	MF,475ohm,1/8W,1%	91637	5-51161
R10	RCR07G561JR	CC,560ohm,1/4W,5%	01121	5-10561
R11	RCR07G622JR	CC,6.2Kohm,1/4W,5%	01121	5-10622
R12	RN55D4750F	MF,475ohm,1/8W,1%	91637	5-51161
R13	RCR07G561JR	CC,560ohm,1/4W,5%	01121	5-10561
R14	RN55D2000F	MF,200ohm,1/8W,1%	91637	5-51125
R15	RN55D8252F	MF,82.5ohm,1/8W,1%	91637	5-51088
R16	RN55D8252F	MF,82.5ohm,1/8W,1%	91637	5-51088
R17	RN55D2211F	MF,2.21Kohm,1/8W,1%	91637	5-51226
R18	RCR07G181JR	CC,180ohm,1/4W,5%	01121	5-10181
R19	RN55D7500F	MF,750ohm,1/8W,1%	91637	5-51181
R20	RCR07G330JR	CC,33ohm,1/4W,5%	01121	5-10330
R21	RN55D69R8F	MF,69.8ohm,1/8W,1%	91637	5-51081
R22	RN55D69R8F	MF,69.8ohm,1/8W,1%	91637	5-51081
R23	RN55D7500F	MF,750ohm,1/8W,1%	91637	5-51181
R24	RN55D2000F	MF,200ohm,1/8W,1%	91637	5-51125
R25	RCR07G330JR	CC,33ohm,1/4W,5%	01121	5-10330
R26	RCR07G181JR	CC,180ohm,1/4W,5%	01121	5-10181
R27	RN55D1330F	MF,133ohm,1/8W,1%	91637	5-51108
R28	360T201B	VAR, CER, 200ohm	71450	5-73201
R29	RN55D4991F	MF,4.99Kohm,1/8W,1%	91637	5-51270
R30	RN55D2741F	MF,2.74Kohm,1/8W,1%	91637	5-51235
R31	RN55D2000F	MF,200ohm,1/8W,1%	91637	5-51125
R32	RN55D7500F	MF,750ohm,1/8W,1%	91637	5-51181
R33	RCR07G181JR	CC,180ohm,1/4W,5%	01121	5-10181
R34	RCR07G330JR	CC,33ohm,1/4W,5%	01121	5-10330
R35	RCR07G471JR	CC,470ohm,1/4W,5%	01121	5-10471
		TRANSISTORS		
Q1	2N5160	PNP, Silicon	04713	3-25160
Q2	2N3904	NPN, Signal	04713	3-23904
Q3	2N3904	NPN, Signal	04713	3-23904
Q4	2N4959	PNP, Silicon	04713	3-24959
Q5	2N5179	NPN, Silicon	04713	3-25179
Q6	2N3904	NPN, Signal	04713	3-23904
Q7	2N3904	NPN, Signal	04713	3-23904
Q8	2N5179	NPN, Silicon	04713	3-25179
Q9	2N5160	PNP, Silicon	04713	3-25160
Q10	2N4959	PNP, Silicon	04713	3-24959

Table 6-6. Parts List (Vertical Output Sub-Assy 9505004) (Continued)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
Q11	2N4959	PNP, Silicon	04713	3-24959
Q12	2N5179	NPN, Silicon	04713	3-25179
Q13	2N3866	NPN, Silicon	04713	3-23866
Q14	2N3904	NPN, Signal	04713	3-23904
Q15	2N3904	NPN, Signal	04713	3-23904
Q16	2N3904	NPN, Signal	04713	3-23904
Q17	2N3904	NPN, Signal	04713	3-23904
Q18	2N3904	NPN, Signal	04713	3-23904
Q19	2N5179	NPN, Silicon	04713	3-25179
Q20	2N5179	NPN, Silicon	04713	3-25179
Q21	2N3904	NPN, Signal	04713	3-23904
Q22	2N4959	PNP, Silicon	04713	3-24959
Q23	2N5179	NPN, Silicon	04713	3-25179
Q24	2N3866	NPN, Silicon	04713	3-23866
Q25	2N3904	NPN, Signal	04713	3-23904
Q26	2N3904	NPN, Signal	04713	3-23904
5'4"	AA 1780	Delay Line	Times Wire and Cable	2-70017
		HARDWARE		
$\overline{DL1}$	MP165-2	Mini-Pin, .3Long	PMP	2-24016
$\overline{DL2}$	MP165-2	Mini-Pin, .3Long	PMP	2-24016
2 Req.	570-1510-01-0519	Standoff	Cambion	4-20199
4 Req.	8787	Spacer,4-40,1/4 X 15/16L	83330	4-20160
2 Req.	8205 male/female	Spacer,4-40,1/4 X 7/8L	83330	4-20270
3 Req.	120	Shaft, Coupler	83330	4-20204
7 Req.	MS51957-13	Screw,4-40 X 1/4 Pan Head	-	8-10013
9 Req.	MS35333-70	Washer, #4 Int. Lk.	-	8-40002
2 Req.	MS51957-12	Screw,4-40 X 3/16 Pan Head	-	8-10012
	8326	Spacer,4-40,1/4 X 7/8L	83330	4-20267

Table 6-7. Parts List (Vertical Input Assy 9505005)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
	9505001	Vertical Input Sub-Assy	34160	
	9352003	Shield,Switch Cover,Right	34160	1-10766
	9502012	Bracket,Vertical Panel	34160	1-10833
	9352011	Bracket, Atten, Spacer	34160	1-10768
	9502011	Vertical Front Panel	34160	1-10832
	9352093	Shield,Switch Cover,Left	34160	1-10835
S201	7101	Switch, Toggle, SPDT	C & K	2-10003
J101,201	UG1094/U	BNC Connector	-	2-28998
J102	256/GRN	Bannana Jack, Green	83330	4-20309
		HARDWARE		
2 Req.	044-2020	Nut Cover, Blk	Interlok	4-10019
	LCBS14N	Standoff,Plastic,7/8"L	Rich Co	4-20264
2 Req.	8787	Spacer,4-40 X 15/16"L	83330	4-20160
6 Req.	9152030	Button	34160	1-10716
2 Req.	023-3520	Knob,Blk. Wing,1/8"Shaft	Interlok	4-10013
2 Req.	021-1230	Knob,Red,1/8"Shaft	Interlok	4-10009
2 Req.	040-1030	Knob Cap,Red	Interlok	4-10010
6 Req.	MS51957-13	Screw,4-40 X 1/4, Pan Hd.	-	8-10013
8 Req.	MS51957-3	Screw,2-56 X 1/4, Pan Hd.	-	8-10003
8 Req.	MS35333-69	Washer, #2 Lock	-	8-40001
9 Req.	MS35333-70	Washer, #4 Int. Lk.	-	8-40002
	MS35333-74	Washer, 1/4 Int. Lk.	-	8-40006
3 Req.	NAS671C4	Nut, 4-40	-	8-30005

Table 6-8. Parts List (Interconnect Sub-Assy 9505006)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
	9505004	Vert Output Bd. Sub-Assy	34160	
	9355009	CRT Control Bd. Sub-Assy	34160	
	9355025	High Voltage Bd. Sub-Assy	34160	
J6	2VH10/1AN5	Connector	Viking	2-24017
P1	03-06-2152	Connector, Plug	Molex	2-24021
15 Req.	02-06-2103	Terminal, Male	Molex	2-24022
XV1 *	B12FN	CRT Socket	Iter-Tech Group, Inc.	2-60010
J5	03-06-1062	Connector, Receptacle	Molex	2-24023
6 Req.	02-06-1103	Terminal, Female	Molex	2-24020
	OCB-375	Bushing, Split	Heyco	2-45008
	B-312-250	Bushing	Heyco	2-45007

*For Telefunken refer to 9355024

Table 6-9. Parts List (Main Chassis Assy 9505007)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
	9505006	Interconnect Sub-Assy	34160	
	9352027	CRT Shield	34160	1-10782
	9352038	CRT Chassis	34160	1-10783
	9352025	Sub Rear Panel	34160	1-10784
	9352011	Bracket, Atten Spacer	34160	1-10768
	9352028	CRT Controls Mount	34160	1-10786
	9352049	Delay Line Retainer	34160	1-10791
L1	9352077	Trace Angle Coil	34160	5-90102
	9352084	H.V. Bd. Insulator	34160	1-10827
V1 *	D10-293	CRT W/Graticule	Brimar	3-40014
		HARDWARE		
2 Req.	SB-250-2	Bushing-Snap	Heyco	2-45006
3 Req.	2370	Spacer,4-40 X 1/4,Thd.	83330	4-20234
2 Req.	8443	Spacer,8-32 X 1/2,Thd.	83330	4-20266
2 Req.	8323	Spacer,4-40 X 1/2,Thd.	83330	4-20027
2 Req.	8781	Spacer,4-40 X 13/16,Thd.	83330	4-20245
	2373	Spacer,4-40 X 3/4,Thd.	83330	4-20166
	MB-100W/701	Machine Bumper, Blk.	Sm Rubber Parts	4-20308
A/R	-	Foam, Self-Adhesive		4-20293
8 Req.	MS24693-2	Screw,4-40 X 1/4,Flat Hd.	-	8-20013
2 Req.	MS51957-15	Screw,4-40 X 3/8,Pan Hd.	-	8-10015
16 Req.	MS51957-13	Screw,4-40 X 1/4,Pan Hd.	-	8-10013
2 Req.	MS51957-14	Screw,4-40 X 5/16,Pan Hd.	-	8-10014
2 Req.	MS51957-41	Screw,8-32 X 1/4,Pan Hd.	-	8-10041
2 Req.	MS35333-72	Washer, #8 Int. Lk.	-	8-40004
21 Req.	MS35333-70	Washer, #4 Int. Lk.	-	8-40002
	MS35333-73	Washer, #10 Int. Lk.	-	8-40005
	NAS671C10	Nut, 10-32	-	8-30008
	9352058-1	935 Insulator	34160	1-20101
	9352058-2	935 Insulator	34160	1-10828
	9352058-3	935 Insulator	34160	1-10829

*For Telefunken CRT refer to 9355025.

Table 6-10. Parts List (Final Assy 9505008)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
		* PS950 -1 Final Assy # PS950/975 -3 Final Assy		
	9505007	Main Chassis Assy	34160	
	9355008	Horizontal Assy	34160	
	9505005	Vertical Input Assy	34160	
	9505002	Vertical Signal Assy	34160	
	9355007	Power Supply Assy	34160	
	9405070	Handle Assy	34160	
	#9755011-3	Chassis Assy 975B	34160	
2 Req.	9352067	Stiffener Plate	34160	1-10806
	9352012	Bezel	34160	1-10790
	9352033	Front Strap	34160	1-10787
	9352014	Bottom Cover	34160	1-10788
	*9352041	Top Cover PS935	34160	1-10792
	#9352031	Top Cover PS935/975	34160	1-10789
2 Req.	9352058-1	Insulator, 935	34160	1-20101
2 Req.	P312	Hole Plug	Heyco	4-20300
	9502010	Bezel Decal	34160	4-20322
4 Req.	F6B	Feet, #6, Cabinet	Budwig	4-20177
	SPH-386	Power Cord	Belden	2-70005
	*9352047	Protective Hood	34160	4-20274
	#9352054	Protective Hood-975	34160	4-20275
		HARDWARE		
7 Req.	MS24693-C2	Screw,4-40 X 1/4,Flat Hd.	-	8-20013
2 Req.	MS51957-15	Screw,4-40 X 3/8,Pan Hd.	-	8-10015
4 Req.	MS51957-30	Screw,6-32 X 1/2,Pan Hd.	-	8-10030
6 Req.	MS51957-13	Screw,4-40 X 1/4,Pan Hd.	-	8-10013
4 Req.	MS35333-71	Washer, #6 Int. Lk.	-	8-40003
2 Req.	MS24693-C9	Screw,4-40 X 7/8,Flat Hd.	-	8-20020
6 Req.	MS35333-70	Washer,#4, Int. Lk.	-	8-40002
2 Req.	#MS51957-13	Screw,4-40 X 1/4,Pan Hd.	-	8-10013
2 Req.	#MS35333-70	Washer, #4, Int. Lk.	-	8-40002
4 Req.	MS24693-C272	Screw,10-32 X 1/2 Flat Hd.	-	8-20063
	PS950/975	Manual Technical	34160	4-20325
	PS950/975	Manual Operators	34160	4-20326

Table 6-11. Parts List (Constant Current Sub-Assy 9355006)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
	9353006	Etched Circuit Board	34160	1-20096
		CAPACITORS		
C1	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C2	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C3	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C4	DM15-471J	DM,470Pf±5%,500V	04062	6-19471
C5	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C6	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C7	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C8	T362C106M035AS	TANT, 10uf±20%,35V	05397	6-75106
		DIODES		
CR1	1N914	GP, Signal	07263	3-10914
CR2	1N914	GP, Signal	07263	3-10914
CR3	1N914	GP, Signal	07263	3-10914
CR4	1N914	GP, Signal	07263	3-10914
CR5	1N914	GP, Signal	07263	3-10914
CR6	1N914	GP, Signal	07263	3-10914
CR7	1N914	GP, Signal	07263	3-10914
CR8	1N914	GP, Signal	07263	3-10914
		INTEGRATED CIRCUITS		
U1	FD1753	DUAL FET	Solitron	3-21753
U2	LM301	OP,Amp	Nat'l	3-30301
		RESISTORS		
R1	RN55D6980F	MF,698ohm,1/8W,1%	91637	5-51178
R2	RN55D3321F	MF,3.32Kohm,1/8W,1%	91637	5-51243
R3	RN55D4021F	MF,4.02Kohm,1/8W,1%	91637	5-51261
R4	RCR07G101JR	CC,100ohm,1/4W,5%	01121	5-10101
R5	RCR07G823JR	CC,82Kohm,1/4W,5%	01121	5-10823
R6	RCR07G101JR	CC,100ohm,1/4W,5%	01121	5-10101
R7	RCR07G823JR	CC,82Kohm,1/4W,5%	01121	5-10823
R8	RCR07G101JR	CC,100ohm,1/4W,5%	01121	5-10101
R9	RCR07G101JR	CC,100ohm,1/4W,5%	01121	5-10101
R10	RCR07G100JR	CC,10ohm,1/4W,5%	01121	5-10100
R11	RN60D1004F	MF,1Mohm,1/8W,1%	91637	5-50490
R12	RN60D6653F	MF,665Kohm,1/8W,1%	91637	5-50473
R13	RCR07G224JR	CC,220Kohm,1/4W,5%	01121	5-10224
R14	RCR07G104JR	CC,100Kohm,1/4W,5%	01121	5-10104

Table 6-11. Parts List (Constant Current Sub-Assy 9355006) (Continued)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
R15	RN55D2493F	MF,249Kohm,1/8W,1%	91637	5-51432
R16	RCR07G224JR	CC,220Kohm,1/4W,5%	01121	5-10224
R17	RCR07G104JR	CC,100Kohm,1/4W,5%	01121	5-10104
R18	RN55D1103F	MF,110Kohm,1/8W,1%	91637	5-51398
R19	RCR07G224JR	CC,220Kohm,1/4W,5%	01121	5-10224
R20	RCR07G104JR	CC,100Kohm,1/4W,5%	01121	5-10104
R21	RN55D3922F	MF,39.2Kohm,1/8W,1%	91637	5-51356
R22	RCR07G224JR	CC,220Kohm,1/4W,5%	01121	5-10224
R23	RCR07G104JR	CC,100Kohm,1/4W,5%	01121	5-10104
R24	RN55D2002F	MF,20.0Kohm,1/8W,1%	91637	5-51328
R25	RCR07G224JR	CC,220Kohm,1/4W,5%	01121	5-10224
R26	RCR07G104JR	CC,100Kohm,1/4W,5%	01121	5-10104
R27	RN55D1002F	MF,10.0Kohm,1/8W,1%	91637	5-51299
R28	RCR07G224JR	CC,220Kohm,1/4W,5%	01121	5-10224
R29	RCR07G104JR	CC,100Kohm,1/4W,5%	01121	5-10104
R30	RN55D3921F	MF,3.92Kohm,1/8W,1%	91637	5-51250
R31	RCR07G224JR	CC,220Kohm,1/4W,5%	01121	5-10224
R32	RCR07G104JR	CC,100Kohm,1/4W,5%	01121	5-10104
R33	RN55D1961F	MF,1.96Kohm,1/8W,1%	91637	5-51221
R34	RCR07G224JR	CC,220Kohm,1/4W,5%	01121	5-10224
R35	RCR07G104JR	CC,100Kohm,1/4W,5%	01121	5-10104
R36	RN55D2551F	MF,2.55Kohm,1/8W,1%	91637	5-51232
R37	RN55D1071F	MF,1.07Kohm,1/8W,1%	91637	5-51196
R38	RN55D2431F	MF,2.43Kohm,1/8W,1%	91637	5-51230
R39	RN55D3570F	MF,357ohm,1/8W,1%	91637	5-51149
R40	RN55D51R1F	MF,51.1ohm,1/8W,1%	91637	5-51068
R41	RN55D46R4F	MF,46.4ohm,1/8W,1%	91637	5-51064
		TRANSISTORS		
Q1	UC410	FET	Solitron	3-20410
Q2	F2701	FET, NCH	Solitron	3-22701
Q3	F2701	FET, NCH	Solitron	3-22701
Q4	F2701	FET, NCH	Solitron	3-22701
Q5	F2701	FET, NCH	Solitron	3-22701
Q6	F2701	FET, NCH	Solitron	3-22701
Q7	F2701	FET, NCH	Solitron	3-22701
Q8	F2701	FET, NCH	Solitron	3-22701
Q9	F2701	FET, NCH	Solitron	3-22701

Table 6-12. Parts List (Power Supply Assy 9355007)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
	9353007	Etched Circuit Board	34160	1-20097
		CAPACITORS		
C1	672D827H015DS5C	ELECT, 820uf, 15V	56289	6-83827
C2	672D827H015DS5C	ELECT, 820uf, 15V	56289	6-83827
C3	672D827H015DS5C	ELECT, 820uf, 15V	56289	6-83827
C4	1802Z5U050A104Z	MONO CER,.1uf +80-20%,50V	Varadyne	6-36104
C5	T362B475M050AS	TANT, 4.7uf±20%, 50V	05397	6-76475
C6	1802Z5U050A104Z	MONO CER,.1uf +80-20%,50V	Varadyne	6-36104
C7	672D827H015DS5C	ELECT, 820uf, 15V	56289	6-83827
C8	672D827H015DS5C	ELECT, 820uf, 15V	56289	6-83827
C9	1802Z5U050A104Z	MONO CER,.1uf +80-20%,50V	Varadyne	6-36104
C10	T362B475M050AS	TANT, 4.7uf±20%, 50V	05397	6-76475
C11	T362B475M050AS	TANT, 4.7uf±20%, 50V	05397	6-76475
C12	1802Z5U050A104Z	MONO CER,.1uf +80-20%,50v	Varadyne	6-36104
C13	1802Z5U050A104Z	MONO CER,.1uf +80-20%,50V	Varadyne	6-36104
C14	T362B475M050AS	TANT, 4.7uf±20%, 50V	05397	6-76475
C15	1802Z5U050A104Z	MONO CER,.1uf +80-20%,50V	Varadyne	6-36104
C16	672D567H020DS5C	ELECT, 560uf, 20V	56289	6-83567
C17	1802Z5U050A104Z	MONO CER,.1uf +80-20%,50V	Varadyne	6-36104
C18	T362B475M050AS	TANT, 4.7uf±20%, 50V	05397	6-76475
C19	1802Z5U050A104Z	MONO CER,.1uf +80-20%,50V	Varadyne	6-36104
C20	672D576H020DS5C	ELECT, 560uf, 20V	56289	6-83567
C21	1802Z5U050A104Z	MONO CER,.1uf +80-20%,50V	Varadyne	6-36104
C22	T362B475M050AS	TANT, 4.7uf±20%, 50V	05397	6-76475
C23	T362B475M050AS	TANT, 4.7uf±20%, 50V	05397	6-76475
C24	1802Z5U050A104Z	MONO CER,.1uf +80-20%,50V	Varadyne	6-36104
C25	672D397H040DS5C	ELECT, 390uf, 40V	56289	6-81397
C26	1802Z5U050A104Z	MONO CER,.1uf +80-20%,50V	Varadyne	6-36104
C27	T362B475M050AS	TANT, 4.7uf±20%, 50V	05397	6-76475
C28	1802Z5U050A104Z	MONO CER,.1uf +80-20%,50V	Varadyne	6-36104
C29	672D397H040DS5C	ELECT, 390uf, 40V	56289	6-81397

Table 6-12. Parts List (Power Supply Assy 9355007) (Continued)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
C30	1802Z5U050A104Z	MONO CER,.1uf +80-20%,50V	Varadyne	6-36104
C31	T362B475M050AS	TANT, 4.7uf±20%, 50V	05397	6-76475
C32	T362B475M050AS	TANT, 4.7uf±20%, 50V	05397	6-76475
C33	1802Z5U050A104Z	MONO CER,.1uf +80-20%, 50V	Varadyne	6-36104
C34	672D108H012DS5C	ELECT, 1000uf, 12V	56289	6-82108
C35	1802Z5U050A104Z	MONO CER,.1uf +80-20%,50V	Varadyne	6-36104
C36	T362B475M050AS	TANT, 4.7uf±20%, 50V	05397	6-76475
		DIODES		
CR1	1N4004	Power, 1 Amp, 400V	07263	3-14004
CR2	1N4004	Power, 1 Amp, 400V	07263	3-14004
CR3	1N4004	Power, 1 Amp, 400V	07263	3-14004
CR4	1N4004	Power, 1 Amp, 400V	07263	3-14004
CR5	1N4004	Power, 1 Amp, 400V	07263	3-14004
CR6	1N4004	Power, 1 Amp, 400V	07263	3-14004
CR7	1N4004	Power, 1 Amp, 400V	07263	3-14004
CR8	1N4004	Power, 1 Amp, 400V	07263	3-14004
CR9	1N4004	Power, 1 Amp, 400V	07263	3-14004
CR10	1N4004	Power, 1 Amp, 400V	07263	3-14004
CR11	1N4004	Power, 1 Amp, 400V	07263	3-14004
CR12	1N4004	Power, 1 Amp, 400V	07263	3-14004
CR13	1N4004	Power, 1 Amp, 400V	07263	3-14004
CR14	1N4004	Power, 1 Amp, 400V	07263	3-14004
CR15	1N4004	Power, 1 Amp, 400V	07263	3-14004
CR16	1N4004	Power, 1 Amp, 400V	07263	3-14004
		INTEGRATED CIRCUITS		
U1	78GU1C	Volt, Reg, uA78GC	07263	3-30780
U2	79GU1C	Volt, Reg, uA79GC	07263	3-30790
U3	78GU1C	Volt, Reg, uA78GC	07263	3-30780
U4	78GU1C	Volt, Reg, uA78GC	07263	3-30780
U5	79GU1C	Volt, Reg, uA79GC	07263	3-30790
U6	78GU1C	Volt, Reg, uA78GC	07263	3-30780
U7	79GU1C	Volt, Reg, uA79GC	07263	3-30790
U8	7805UC	Volt, Reg, uA7805C	07263	3-37805
		RESISTORS		
R1	360T202B	VAR, CER, 2Kohm	71450	5-73202

Table 6-12. Parts List (Power Supply Assy 9355007) (Continued)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
R2	RN55D2491F	MF,2.49Kohm,1/8W,1%	91637	5-51231
R3	RN55D4991F	MF,4.99Kohm,1/8W,1%	91637	5-51270
R4	RN55D2211F	MF,2.21Kohm,1/8W,1%	91637	5-51226
R5	RN55D5231F	MF,5.23Kohm,1/8W,1%	91637	5-51272
R6	360T202B	VAR, CER, 2Kohm	71450	5-73202
R7	RN55D3011F	MF,3.01Kohm,1/8W,1%	91637	5-51239
R8	RN55D4991F	MF,4.99Kohm,1/8W,1%	91637	5-51270
R9	360T502B	VAR, CER, 5Kohm	71450	5-73502
R10	RN55D6651F	MF,6.65Kohm,1/8W,1%	91637	5-51282
R11	RN55D4991F	MF,4.99Kohm,1/8W,1%	91637	5-51270
R12	RN55D2211F	MF,2.21Kohm,1/8W,1%	91637	5-51226
R13	RN55D8871F	MF,8.87Kohm,1/8W,1%	91637	5-51294
R14	360T502B	VAR, CER, 5Kohm	71450	5-73502
R15	RN55D2492F	MF,24.9Kohm,1/8W,1%	91637	5-51337
R16	RN55D4991F	MF,4.99Kohm,1/8W,1%	91637	5-51270
R17	RN55D2211F	MF,2.21Kohm,1/8W,1%	91637	5-51226
R18	RN55D2742F	MF,27.4Kohm,1/8W,1%	91637	5-51341
T1	9352048	Power Transformer	34160	7-61024
	9352079	Decal, Serial No.	34160	4-20311
	9352080	Decal, Cal	34160	4-20312
	9352026	Power Supply Chassis	34160	1-10775
	9352034	Power Supply Heat Sink	34160	1-10776
	9352024	Transformer Bracket	34160	1-10777
2 Req.	9352029	Power Supply Support Bracket	34160	1-10778
	9352057	Power Supply Cover	34160	1-10824
4 Req.	F6B	Feet, Cabinet	Budwig	4-20177
3 Req.	2630-N-12425-093	Washer, Shoulder	Amatom	8-60001
3 Req.	7403-09FR-51	Silicon Insulator	Berquist	4-20290
J7	6J1	Voltage Selector and Fused Connector	Corcom	2-40015
J1	03-06-1152	Connector, Receptacle	Molex	2-24027
15 Req.	02-06-7103	Terminal, Female	Molex	2-24028
F1	313.500**	Fuse, S.B. 3AG, 1/2A	Littlefuse	2-40017**
F2	313.250**	Fuse, S.B. 3AG, 1/4A	Littlefuse	2-40004**
	MS51957-15	Screw, 4-40 X 3/8, Panhead	-	8-10015
4 Req.	MS51957-13	Screw, 4-40 X 1/4, Panhead	-	8-10013

** For 115V operation use 1/2A: 230V use 1/4A.

Table 6-12. Parts List (Power Supply Assy 9355007) (Continued)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
4 Req.	MS51957-51	Screw, 8-32 X 1 1/2, SS, Panhead	-	8-10051
3 Req.	-	Screw, 2-56 X 1/4, Flathead	-	8-20003
2 Req.	MS24693-4	Screw, 4-40 X 3/8, SS, Flathead	-	8-20015
4 Req.	MS51957-30	Screw, 6-32 X 1/2, Panhead	-	8-10030
2 Req.	NAS671C8	Nut, 8-32	-	8-30007
3 Req.	NAS671C2	Nut, 2-56	-	8-30003
5 Req.	NAS671C4	Nut, 4-40	-	8-30005
4 Req.	MS35333-72	Washer, #8 Int. Lk.	-	8-40004
7 Req.	MS35333-70	Washer, #4 Int. Lk.	-	8-40002
3 Req.	MS35333-69	Washer, #2 Int. Lk.	-	8-40001
4 Req.	MS35333-71	Washer, #6 Int. Lk.	-	8-40003
S 1	7101 W/J Rocker	Switch, SPDT	C & K	2-10059
6 Req.	2634-21650-N171	Washer, Nylon shoulder	Amatom	8-60009
2 Req.	2516	Washer, Nylon flat	83330	8-60010

Table 6-13. Parts List (Horizontal Assy 9355008)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
	9355027	Horiz Bd. Sub-Assy	34160	
	9355006	Constant Current, Sub-Assy	34160	
	9352020	Horizontal Chassis	34160	1-10771
	9352018	Horiz, Switch Bracket	34160	1-10772
	9352019	Horiz, Pot Bracket	34160	1-10773
	9352072	Horiz, Front Panel	34160	1-10822
S301	45734-724MR-2	Sweep Selector, Rotary Switch	82104	2-10054
R304, S304	2432001-4	Horiz Vern, Mod Pot	34160	5-79252
R303, S303	2432001-1	Trigger Level, Mod Pot	34160	5-78203
R301, 302, S302	2432001-9	Horiz Pos, Mod Pot	34160	5-78201
S305	9352051	Filter Select, Sw 2Sta	34160	2-10055
	9352071	CRT Filter	34160	4-20132
J301	UG1094/U	BNC Connector	-	2-28998
5 Req.	9152030	Buttons	34160	1-10716
	021-2220	Knob, Blk 10mm, 1/8" Shaft	Interlok	4-10011
	023-3520	Knob, Blk Wing, 14.5mm 1/4" Shaft	Interlok	4-10013
	021-3520	Knob, Blk W/Line 14.5mm, 1/4" Shaft	Interlok	4-10026
2 Req.	021-1230	Knob, Red, 1/8" Shaft, 9mm	Interlok	4-10009
2 Req.	040-1030	Knob Cap, Red	Interlok	4-10010
	9352042	Knob Cap, Red X 10	34160	4-10027
6 Req.	2275-N120	Washer,Flat Nylon	Amatom	8-60007
J302	63-1000-101	Test Jack, White,Probe	83330	2-50009
	9402084	Coupler, 1/8" Shaft	34160	1-10699
	044-2020	Nut Cover, Blk	Interlok	4-10019
	9352039	Shaft, Extension	34160	1-10804
2 Req.	MS51963-9	Set Screw, Allen Head 4-40 X 1/8	-	8-90001
2 Req.	MS51957-13	Screw, 4-40 X 1/4, Panhead	-	8-10013
12 Req.	MS51957-15	Screw, 4-40 X 3/8, Panhead	-	8-10015
14 Req.	MS35333-70	Washer, #4 Int. Lk.	-	8-40002
2 Req.	2373	Spacer, 4-40 X 3/4, Threaded	83330	4-20166
4 Req.	-	Screw, 4-40 X 1/8,Fthd	-	8-20011

Table 6-14. Parts List (CRT Control Sub-Assy 9355009)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
	9353009	Etched Circuit Board	34160	1-20098
		RESISTORS		
R101	3386R-1-104	VAR, CER, 100Kohm	80294	5-73174
R102	3386R-1-103	VAR, CER, 10Kohm	80294	5-73173
R103	MLC252L	VAR, CAR, 2.5Kohm	76055	5-78252
R104	MLCN5M	VAR, 5Mohm	76055	5-78505
DS1	249-7968-3332-504	Indicator Light	Dialight	3-13332
2 Req.	021-2220	Knob, Blk, 10mm, 1/8" Shaft	Interlok	4-10011
2 Req.	040-1020	Knob Cap, Blk	Interlok	4-10012

Table 6-15. Parts List (6KV High Voltage Sub-Assy 9355025)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
	9353025	Etched Circuit Board	34160	1-20104
		CAPACITORS		
C1	2130Z5U050R474M	MonoCer,.47uf±20%,50V	Varadyne	6-36474
C2	1802Z5U05A104Z	MonoCer,.1uf+80-20%50V	Varadyne	6-36104
C3	T362D227M010As	TANT,220uf±20%,10V	05397	6-76227
C4	30GA-D50	CD,.005uf±20%,3KV	56289	6-20502
C5	30GA-D50	CD,.005uf±20%,3KV	56289	6-20502
C6	30GA-D50	CD,.005uf±20%,3KV	56289	6-20502
C7	30GA-D50	CD,.005uf±20%,3KV	56289	6-20502
C8	.003-5-8000	MM,.0033uf,8KV	F-DYNE	6-40332
C9	5GA-S10	CD,.01uf±20%,1KV	56289	6-29053
C10	ZA4470	MM,.1uf±20%,1500V	27556	6-40104
C11	5GA-S10	CD,.01uf±20%,1KV	56289	6-29053
C12	5GA-S10	CD,.01uf±20%,1KV	56289	6-29053
C13	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C14	1802Z5U050A104Z	MonoCer,.1uf+80-20%50V	Varadyne	6-36104
C15	1802Z5U050A104Z	MonoCer,.1uf+80-20%50V	Varadyne	6-36104
C16	1802Z5U050A104Z	MonoCer,.1uf+80-20%50V	Varadyne	6-36104
C17	30GA-D50	CD,.005uf±20%,3KV	56289	6-20502
C18	1802Z5U050A104Z	MonoCer,.1uf+80-20%50V	Varadyne	6-36104
C19	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C20	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C21	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C22	T362C106M035AS	TANT,10uf±20%,35V	05397	6-75106
C23	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C24	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C25	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C26	DM15-681J	DM,68Pf±5%,500V	04062	6-19680
C27	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C28	T362C476M020AS	TANT,47uf±20%,20V	05397	6-74476
C29	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C30	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C31	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C32	T362C106M035AS	TANT,10uf±20%,35V	05397	6-75106
C33	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C34	1802Z5U050A104Z	MonoCer,.1uf+80-20%50V	Varadyne	6-36104
C35	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
* C36	30GA-T39	CD,.390Pf±20%,3KV	56289	6-29391
* C37	1802Z5U050A104Z	MonoCer,.1uf+80-20%50V	Varadyne	6-36104
C38-N	T362B225M035AS	TANT,2.2uf±20%,35KV	05397	6-75225
C39	30GA-D50	CD,.005uf+20%,3KV	56289	6-20502
C40	30GA-D50	CD,.005uf+20%,3KV	56289	6-20502
C41	1802Z5U050A104Z	MonoCer,.1uf+80-20%50V	Varadyne	6-36104

*-Found on CRT socket.
-N Indicates nominal value.

Table 6-15. Parts List (6KV High Voltage Sub-Assy 9355025) (Continued)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
		DIODES		
CR1	SEF40	Rectifier	14099	3-10340
CR2	SEF40	Rectifier	14099	3-10340
CR3	SEF40	Rectifier	14099	3-10340
CR4	SEF40	Rectifier	14099	3-10340
CR5	SEF40	Rectifier	14099	3-10340
CR6	1N914	GP, Signal	07263	3-10914
CR7	1N914	GP, Signal	07263	3-10914
CR8	1N914	GP, Signal	07263	3-10914
CR9	1N914	GP, Signal	07263	3-10914
CR10	1N914	GP, Signal	07263	3-10914
CR11	1N914	GP, Signal	07263	3-10914
CR12	1N914	GP, Signal	07263	3-10914
CR13	1N914	GP, Signal	07263	3-10914
CR14 - CR26	--	- -----	----	-----
CR27	1N914	GP, Signal	07263	3-10914
CR28	1N914	GP, Signal	07263	3-10914
CR29	SEF40	Rectifier	14099	3-10340
CR30	SEF40	Rectifier	14099	3-10340
TP1	MP165-2	Mini-pin, .3L	PMP	2-24016
TP2	MP165-2	Mini-pin, .3L	PMP	2-24016
		RESISTORS		
R1	RCR07G472JR	CC,4.7Kohm,1/4W,5%	01121	5-10472
R2	RCR07G226JR	CC,22Mohm,1/4W,5%	01121	5-10226
R3	RCR07G223JR	CC,22Kohm,1/4W,5%	01121	5-10223
R4	RCR07G155JR	CC,1.5Mohm,1/4W,5%	01121	5-10155
R5	RCR07G101JR	CC,100ohm,1/4W,5%	01121	5-10101
R6	RCR07G153JR	CC,15Kohm,1/4W,5%	01121	5-10153
R7	RCR07G153JR	CC,15Kohm,1/4W,5%	01121	5-10153
R8	RCR07G271JR	CC,270ohm,1/4W,5%	01121	5-10271
R9	RCR07G624JR	CC,620Kohm,1/4W,5%	01121	5-10624
R10	RCR07G224JR	CC,220Kohm,1/4W,5%	01121	5-10224
R11	RCR07G272JR	CC,2.7Kohm,1/4W,5%	01121	5-10272

Table 6-15. Parts List (6KV High Voltage Sub-Assy 9355025) (Continued)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
R12	RCR07G103JR	CC,10Kohm,1/4W,5%	01121	5-10103
R13	RCR07G395JR	CC,3.9Mohm,1/4W,5%	01121	5-10395
R14	RCR07G825JR	CC,8.2Mohm,1/4W,5%	01121	5-10825
R15	RCR07G825JR	CC,8.2Mohm,1/4W,5%	01121	5-10825
R16	360T104B	VAR, CER, 100Kohm	71450	5-73104
R17	RCR07G114JR	CC,110Kohm,1/4W,5%	01121	5-10114
R18	RCR07G156JR	CC,15Mohm,1/4W,5%	01121	5-10156
R19	360T105B	VAR, CER, 1Mohm	71450	5-73105
R20				
R21	RCR07G822JR	CC,8.2Kohm,1/4W,5%	01121	5-10822
R22	RN60D2553F	MF,255Kohm,1/8W,1%	91637	5-50433
R23	RN55D1652F	MF,16.5Kohm,1/8W,1%	91637	5-51320
R24	RCR07G102JR	CC,1Kohm,1/4W,5%	01121	5-10102
R25	RCR07G221JR	CC,220ohm,1/4W,5%	01121	5-10221
R26	RCR07G221JR	CC,220ohm,1/4W,5%	01121	5-10221
R27	RCR07G620JR	CC,62ohm,1/4W,5%	01121	5-10620
R28	RCR07G620JR	CC,62ohm,1/4W,5%	01121	5-10620
R29	RCR07G681JR	CC,680ohm,1/4W,5%	01121	5-10681
R30	RCR07G222JR	CC,2.2Kohm,1/4W,5%	01121	5-10222
R31	RCR07G222JR	CC,2.2Kohm,1/4W,5%	01121	5-10222
R32	RCR07G681JR	CC,680ohm,1/4W,5%	01121	5-10681
R33	RCR07G391JR	CC,390ohm,1/4W,5%	01121	5-10391
R34	RN55D1022F	MF,10.2Kohm,1/8W,1%	91637	5-51300
R35	RCR07G391JR	CC,390ohm,1/4W,5%	01121	5-10391
R36	RCR07G100JR	CC,10ohm,1/4W,5%	01121	5-10100
R37	RCR07G221JR	CC,220ohm,1/4W,5%	01121	5-10221
R38	RCR07G221JR	CC,220ohm,1/4W,5%	01121	5-10221
R39	RCR07G682JR	CC,6.8Kohm,1/4W,5%	01121	5-10682
R40	RCR07G102JR	CC,1Kohm,1/4W,5%	01121	5-10102
R41	RCR07G472JR	CC,4.7Kohm,1/4W,5%	01121	5-10472
R42	360T202B	VAR, CER, 2Kohm	71450	5-73202
R43	RCR07G390JR	CC,39ohm,1/4W,5%	01121	5-10390
R44	RCR07G121JR	CC,120ohm,1/4W,5%	01121	5-10121
R45	RCR07G121JR	CC,120ohm,1/4W,5%	01121	5-10121
R46	RCR07G221JR	CC,220ohm,1/4W,5%	01121	5-10221
R47	360T501B	VAR, CER, 500ohm	71450	5-73501
R48	RCR07G100JR	CC,10ohm,1/4W,5%	01121	5-10100
R49	RCR07G332JR	CC,3.3Kohm,1/4W,5%	01121	5-10332
R50	RCR07G103JR	CC,10Kohm,1/4W,5%	01121	5-10103
R51	RCR07G100JR	CC,10ohm,1/4W,5%	01121	5-10100
R52	RCR07G101JR	CC,100ohm,1/4W,5%	01121	5-10101
R53	RCR07G472JR	CC,4.7Kohm,1/4W,5%	01121	5-10472
R54	RCR07G622JR	CC,6.2Kohm,1/4W,5%	01121	5-10622
R55	RCR07G622JR	CC,6.2Kohm,1/4W,5%	01121	5-10622
R56	RCR07G102JR	CC,1Kohm,1/4W,5%	01121	5-10102
R57	RCR07G102JR	CC,1Kohm,1/4W,5%	01121	5-10102

Table 6-15. Parts List (6KV High Voltage Sub-Assy 9355025) (Continued)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
R58				
R59				
R60				
R61				
R62	RN55D1052F	MF,10.5Kohm,1/8W,1%	91637	5-51301
R63	RN55D6651F	MF,6.65Kohm,1/8W,1%	91637	5-51282
T1	9352017	Transformer, High Voltage	34160	7-61023
		TRANSISTORS		
Q1	D44H2	NPN, Power	GE	3-24442
Q2	D44H2	NPN, Power	GE	3-24442
Q3	2N3694	NPN, Signal	07263	3-23694
Q4	2N4250	PNP, Signal	07263	3-24250
Q5	2N4250	PNP, Signal	07263	3-24250
Q6	2N5087	PNP, Signal	04713	3-25087
Q7	2N3904	NPN, Signal	04713	3-23904
Q8	2N3904	NPN, Signal	04713	3-23904
Q9	2N5087	PNP, Signal	04713	3-25087
Q10	2N5087	PNP, Signal	04713	3-25087
Q11	2N3904	NPN, Signal	04713	3-23904
Q12	2N3906	PNP, Signal	04713	3-23906
Q13	2N3904	NPN, Signal	04713	3-23904
Q14	2N3904	NPN, Signal	04713	3-23904
Q15	2N3906	PNP, Signal	04713	3-23906
Q16	2N3904	NPN, Signal	04713	3-23904
Q17	2N3904	NPN, Signal	04713	3-23904
Q18	2N3904	NPN, Signal	04713	3-23904
Q19	2N3904	NPN, Signal	04713	3-23904
Q20	2N3904	NPN, Signal	04713	3-23904
Q21	2N3904	NPN, Signal	04713	3-23904
Q22- Q24	2N3904	NPN, Signal	04713	3-23904
		HARDWARE		
	570-1510-01-0519	Standoff	Cambion	4-20199
	MS51957-12	Screw,4-40 x 3/16, Panhead	-	8-10012
	MS35333-70	Washer,#4 Int. Lk	-	8-40002

Table 6-16. Parts List (Horizontal Sub-Assy 9355027)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
	9353027	Etched Circuit Board	34160	1-20105
		CAPACITORS		
C1	DM15-270J	DM,27Pf±5%,500V	04062	6-19270
C2	5HK-P10	CD,.1uf+80-20%,500V	56289	6-29103
C3[1]	DM15-101	DM,100Pf±5%,500V	04062	6-19101
C4	D155F560J	DM,56Pf±5%,500V	00853	6-19560
C5	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C6	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C7	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C8	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C9	DM15-150J	DM,15Pf±5%,500V	04062	6-19150
C10	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C11	DM15-150J	DM,15Pf±5%,500V	04062	6-19150
C12	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C13	2130Z5U100R104ZC	MonoCer,.1uf+80-20%100V	Varadyne	6-37104
C14	T362D107M020AS	TANT,100uf±20%,20V	05397	6-74107
C15	T362D107M020AS	TANT,100uf±20%,20V	05397	6-74107
C16	2130Z5U100R104ZC	MonoCer,.1uf+80-20%100V	Varadyne	6-37104
C17	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C18	T362C476M020AS	TANT,47uf±20%,20V	05397	6-74476
C19	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C20	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C21	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C22	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C23	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C24	DM15-220J	DM,22Pf±5%,500V	04062	6-19220
C25	XA2A474J	MM,.47uf±5%,50V	27556	6-46474
C26	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C27	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C28	DM15-150J	DM,15Pf±.5Pf,500V	04062	6-19150
C29	DM15-050D	DM,5Pf±.5Pf,500V	04062	6-19050
C30	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C31	T362C476M020AS	TANT,47uf±20%,20V	05397	6-74476
C32	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C33	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C34	DM15-101J	DM,100Pf±5%,500V	04062	6-19101
C35	1801Z5U050A223Z	MonoCer,.022uf,50V	Varadyne	6-36223
C36	T362A105M035AS	TANT,1.0uf±20%,35V	05397	6-75105
C37	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C38	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C39	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C40	DM15-101J	DM,100Pf±5%,500V	04062	6-19101
C41	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103

[1]Found on S305a,switch, Front Panel.

Table 6-16. Parts List (Horizontal Sub-Assy 9355027) (Continued)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
C42	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C43	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C44	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C45	9352006	2.5uf±5%,50V } Matched	34160	6-56007
C46		.25uf±5%,50V } Set		
C47	DM15-180J	DM,18Pf±5%,500V	04062	6-19180
C48	DM15-151J	DM,150Pf±5%,500V	04062	6-19151
C49	538-011,D,9-35Pf	VAR, CER, 9-35Pf	Erie	6-96007
C50	538-011,A,2-8Pf	VAR, CER, 2-8Pf	Erie	6-96002
C51	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C52	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C53	1802Z5U050A104Z	MonoCer,.1uf+80-20%,50V	Varadyne	6-36104
C54	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C55	1802Z5U050A104Z	MONO CER,.1uf +80-20%,50V	Varadyne	6-36104
C56	T362C476M020AS	TANT,47uf±20%,20V	05397	6-74476
C57	XA2A103J	MM,.01uf±5%,50V	27556	6-46103
C58	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C59	DM15-471J	DM,470Pf±5%,500V	04062	6-19471
C60	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C61-N	DM15-270J	DM,27Pf±5%,500V	04062	6-19270
C62	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C63	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C64	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C65	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C66	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C67	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C68	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C69	T362C476M020AS	TANT,47uf±20%,20V	05397	6-74476
C70	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C71	-	TBD	-	-
C72-N	DM15-471J	DM,470Pf±5%,500V	04062	6-19471
C73	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C74	T362C476M020AS	TANT,47uf±20%,20V	05397	6-74476
C75	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C76	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C77	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C78	-	-	-	-
C79	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C80	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C81	T362C106M035AS	TANT,10uf±20%,35V	05397	6-75106
C82	T362C476M020AS	TANT,47uf±20%,20V	05397	6-74476
C83	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C84	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C85	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103

-N Indicates nominal value.

Table 6-16. Parts List (Horizontal Sub-Assy 9355027) (Continued)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
C86	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C87	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C88	T362C106M035AS	TANT,10uf±20%,35V	05397	6-75106
C89	538-011,A,2-8Pf	VAR, CER, 2-8Pf	Erie	6-96002
C90	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C91	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C92	T362C476M020AS	TANT,47uf±20%,20V	05397	6-74476
C93	DM15-101D	DM,1PF±.5Pf,500V	04062	6-19010
C94	DM15-102D	DM,2Pf±.5Pf,500V	04062	6-19020
C95	2130Z5U100R104ZC	MonoCer,.1uf+80-20%100V	Varadyne	6-37104
C96	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C97	DM15-270J	DM,27Pf±5%,500V	04062	6-19270
		CHOKES		
L1-L7	.115 X .125	Ferrite Bead	Amidon	5-90001
		DIODES		
CR1	1N914	GP, Signal	07263	3-10914
CR2	1N914	GP, Signal	07263	3-10914
CR3	1N914	GP, Signal	07263	3-10914
CR4	FD300	Low Leakage	07263	3-10300
CR5	FD300	Low Leakage	07263	3-10300
CR6	1N914	GP, Signal	07263	3-10914
CR7	1N914	GP, Signal	07263	3-10914
CR8	1N914	GP, Signal	07263	3-10914
CR9	1N914	GP, Signal	07263	3-10914
CR10	1N914	GP, Signal	07263	3-10914
CR11	1N914	GP, Signal	07263	3-10914
CR12	MBD701	Schottky	04713	3-10701
CR13	MBD701	Schottky	04713	3-10701
CR14	1N914	GP, Signal	07263	3-10914
CR15	1N914	GP, Signal	07263	3-10914
CR16	MBD701	Schottky	04713	3-10701
CR17	IN914	GP, Signal	07263	3-10914
CR18	MBD701	Schottky	04713	3-10701
CR19	1N914	GP, Signal	07263	3-10914
CR20	1N914	GP, Signal	07263	3-10914
CR21	MBD701	Schottky	04713	3-10701
CR22	FD300	Low Leakage	07263	3-10300
CR23	FD300	Low Leakage	07263	3-10300
CR24	FD300	Low Leakage	07263	3-10300
CR25	1N914	GP, Signal	07263	3-10914

Table 6-16. Parts List (Horizontal Sub-Assy 9355027) (Continued)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
CR26	FD300	Low Leakage	07263	3-10300
CR27	FD300	Low Leakage	07263	3-10300
CR28	FD300	Low Leakage	07263	3-10300
CR29	FD300	Low Leakage	07263	3-10300
CR30	FD300	Low Leakage	07263	3-10300
CR31	FD300	Low Leakage	07263	3-10300
CR32	1N914	GP, Signal	07263	3-10914
CR33	1N914	GP, Signal	07263	3-10914
CR34	1N914	GP, Signal	07263	3-10914
CR35	1N914	GP, Signal	07263	3-10914
CR36	1N914	GP, Signal	07263	3-10914
		INTEGRATED CIRCUITS		
U1	FD1846	FET, DUAL, NCH	Solitron	3-21846
U2	AM686CN	COMP, AM686	AMD	3-30686
U3	FD1846	FET, DUAL, NCH	Solitron	3-21846
U4	NE555V	Timer	Signetics	3-30555
		RESISTORS		
R1	RN60D6653F	MF,665Kohm,1/8W,1%	91637	5-50473
R2	RN60D4993F	MF,499Kohm,1/8W,1%	91637	5-50461
R3	RN55D7872F	MF,78.7Kohm,1/8W,1%	91637	5-51384
R4[1]	RCR07G273JR	CC,27Kohm,1/4W,5%	01121	5-10273
R5	RCR07G103JR	CC,10Kohm,1/4W,5%	01121	5-10103
R6	RCR07G562JR	CC,5.6Kohm,1/4W,5%	01121	5-10562
R7	RCR07G562JR	CC,5.6Kohm,1/4W,5%	01121	5-10562
R8	RCR07G105JR	CC,1Mohm,1/4W,5%	01121	5-10105
R9	RN55D7681F	MF,7.68Kohm,1/8W,1%	91637	5-51288
R10	RN55D1152F	MF,11.5Kohm,1/8W,1%	91637	5-51305
R11	RCR07G101JR	CC,100ohm,1/4W,5%	01121	5-10101
R12	RN55D1001F	MF,1.00Kohm,1/8W,1%	91637	5-51193
R13	RN55D6980F	MF,698ohm,1/8W,1%	91637	5-51178
R14	360T101B	VAR, CER, 100ohm	71450	5-73101
R15	RCR07G101JR	CC,100ohm,1/4W,5%	01121	5-10101
R16	RCR07G473JR	CC,47Kohm,1/4W,5%	01121	5-10473
R17	RCR07G223JR	CC,22Kohm,1/4W,5%	01121	5-10223
R18	RN55D3741F	MF,3.74Kohm,1/8W,1%	91637	5-51248
R19	RN55D1241F	MF,1.24Kohm,1/8W,1%	91637	5-51202
R20	RN55D66R5F	MF,66.5ohm,1/8W,1%	91637	5-51079
R21	RN55D76R8F	MF,76.8ohm,1/8W,1%	91637	5-51085

[1] Found on S305b switch, Front Panel.

Table 6-16. Parts List (Horizontal Sub-Assy 9355027) (Continued)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
R22	RN55D1910F	MF,1910hm,1/8W,1%	91637	5-51123
R23	RN55D3161F	MF,3.16Kohm,1/8W,1%	91637	5-51241
R24	RN55D66R5F	MF,66.5ohm,1/8W,1%	91637	5-51079
R25	RN55D76R8F	MF,76.8ohm,1/8W,1%	91637	5-51085
R26	RN55D1102F	MF,11.0Kohm,1/8W,1%	91637	5-51303
R27	RN55D66R5F	MF,66.5ohm,1/8W,1%	91637	5-51079
R28	RN55D1910F	MF,1910hm,1/8W,1%	91637	5-51123
R29	RN55D3161F	MF,3.16Kohm,1/8W,1%	91637	5-51241
R30	RN55D66R5F	MF,66.5ohm,1/8W,1%	91637	5-51079
R31	RN55D1102F	MF,11.0Kohm,1/8W,1%	91637	5-51303
R32	RCR07G820JR	CC,820hm,1/4W,5%	01121	5-10820
R33	RCR07G131JR	CC,1300hm,1/4W,5%	01121	5-10131
R34	RCR07G153JR	CC,15Kohm,1/4W,5%	01121	5-10153
R35	RCR07G153JR	CC,15Kohm,1/4W,5%	01121	5-10153
R36	RN55D75R0F	MF,75.0ohm,1/8W,1%	91637	5-51084
R37	RN55D2210F	MF,2210hm,1/8W,1%	91637	5-51129
R38	RN55D64R9F	MF,64.9ohm,1/8W,1%	91637	5-51078
R39	RN55D5490F	MF,5490hm,1/8W,1%	91637	5-51167
R40	RN55D2210F	MF,2210hm,1/8W,1%	91637	5-51129
R41	RN55D64R9F	MF,64.9ohm,1/8W,1%	91637	5-51078
R42	RN55D4990F	MF,4990hm,1/8W,1%	91637	5-51163
R43	RN55D6191F	MF,6.19Kohm,1/8W,1%	91637	5-51279
R44	RN55D75R0F	MF,75.0ohm,1/8W,1%	91637	5-51084
R45	RN55D6491F	MF,6.49Kohm,1/8W,1%	91637	5-51281
R46	RN55D1431F	MF,1.43Kohm,1/8W,1%	91637	5-51208
R47	RN55D4751F	MF,4.75Kohm,1/8W,1%	91637	5-51268
R48	RN55D1050F	MF,1050hm,1/8W,1%	91637	5-51098
R49	RN55D3320F	MF,3320hm,1/8W,1%	91637	5-51146
R50	RN55D82R5F	MF,82.5ohm,1/8W,1%	91637	5-51088
R51	RCR07G301JR	CC,3000hm,1/4W,5%	01121	5-10301
R52	360T201B	VAR, CER, 200ohm	71450	5-73201
R53	RN55D1050F	MF,1050hm,1/8W,1%	91637	5-51098
R54	RN55D3320F	MF,3320hm,1/8W,1%	91637	5-51146
R55	RCR07G152JR	CC,1.5Kohm,1/4W,5%	01121	5-10152
R56	RCR07G471JR	CC,4700hm, 1/4W,5%	01121	5-10471
R57	RCR07G102JR	CC,1Kohm,1/4W,5%	01121	5-10102
R58	RCR07G103JR	CC,10Kohm,1/4W,5%	01121	5-10103
R59	RCR07G433JR	CC,43Kohm,1/4W,5%	01121	5-10443
R60	RCR07G822JR	CC,8.2Kohm,1/4W,5%	01121	5-10822
R61	RCR07G433JR	CC,43Kohm,1/4W,5%	01121	5-10433
R62	RCR07G101JR	CC,1000hm,1/4W,5%	01121	5-10101
R63	RCR07G273JR	CC,27Kohm,1/4W,5%	01121	5-10273
R64	RCR07G273JR	CC,27Kohm,1/4W,5%	01121	5-10273
R65	RN55D2102F	MF,21.0Kohm,1/8W,1%	91637	5-51330
R66	RN55D5491F	MF,5.49Kohm,1/8W,1%	91637	5-51274

Table 6-16. Parts List (Horizontal Sub-Assy 9355027) (Continued)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
R67	RN55D3320F	MF,332ohm,1/8W,1%	91637	5-51146
R68	RCR07G222JR	CC,2.2Kohm,1/4W,5%	01121	5-10222
R69	RCR07G682JR	CC,6.8Kohm,1/4W,5%	01121	5-10682
R70	RCR07G223JR	CC,22Kohm,1/4W,5%	01121	5-10223
R71	RCR07G102JR	CC,1Kohm, 1/4W,5%	01121	5-10102
R72	RCR07G273JR	CC,27Kohm,1/4W,5%	01121	5-10273
R73	RN55D1053F	MF,105Kohm,1/8W,1%	91637	5-51396
R74	RN55D4121F	MF,4.12Kohm,1/8W,1%	91637	5-51262
R75	RN55D1961F	MF,1.96Kohm,1/8W,1%	91637	5-51221
R76	RN55D2670F	MF,267ohm,1/8W,1%	91637	5-51137
R77	RN55D5361F	MF,5.36Kohm,1/8W,1%	91637	5-51273
R78	RN55D3400F	MF,340ohm,1/8W,1%	91637	5-51147
R79	RN55D4220F	MF,422ohm,1/8W,1%	91637	5-51156
R80	RN55D2670F	MF,267ohm,1/8W,1%	91637	5-51137
R81	RN55D6342F	MF,63.4Kohm,1/8W,1%	91637	5-51375
R82	RN55D1652F	MF,16.5Kohm,1/8W,1%	91637	5-51320
R83	RN55D6650F	MF,665ohm,1/8W,1%	91637	5-51175
R84	RN55D5112F	MF,51.1Kohm,1/8W,1%	91637	5-51367
R85	RN55D2872F	MF,28.7Kohm,1/8W,1%	91637	5-51343
R86	RCR07G753JR	CC,75Kohm,1/4W,5%	01121	5-10753
R87	RCR07G106JR	CC,10Mohm,1/4W,5%	01121	5-10106
R88	RCR07G106JR	CC,10Mohm,1/4W,5%	01121	5-10106
R89	RCR07G473JR	CC,47Kohm,1/4W,5%	01121	5-10473
R90	RCR07G682JR	CC,6.8Kohm,1/4W,5%	01121	5-10682
R91	RCR07G473JR	CC,47Kohm,1/4W,5%	01121	5-10473
R92	RCR07G682JR	CC,6.8Kohm,1/4W,5%	01121	5-10682
R93	RN55D4121F	MF,4.12Kohm,1/8W,1%	91637	5-51262
R94	RN55D8251F	MF,8.25Kohm,1/8W,1%	91637	5-51291
R95	RCR07G821JR	CC,820ohm,1/4W,5%	01121	5-10821
R96	RN55D2000F	MF,200ohm,1/8W,1%	91637	5-51125
R97	RN55D2741F	MF,2.74Kohm,1/8W,1%	91637	5-51235
R98	RN55D9531F	MF,9.53Kohm,1/8W,1%	91637	5-51297
R99	RN55D1331F	MF,1.33Kohm,1/8W,1%	91637	5-51205
R100	RN55D4420F	MF,442ohm,1/8W,1%	91637	5-51158
R101	RCR07G102JR	CC,1Kohm,1/4W,5%	01121	5-10102
R102	RN55D7320F	MF,732ohm,1/8W,1%	91637	5-51180
R103	RN55D6651F	MF,6.65Kohm,1/8W,1%	91637	5-51282
R104	RN55D8661F	MF,8.66Kohm,1/8W,1%	91637	5-51293
R105	RCR07G101JR	CC,100ohm,1/4W,5%	01121	5-10101
R106	RN55D2210F	MF,221ohm,1/8W,1%	91637	5-51129
R107	RN55D6650F	MF,665ohm,1/8W,1%	91637	5-51175
R108	RN55D1000F	MF,100ohm,1/8W,1%	91637	5-51096
R109	RN55D49R9F	MF,49.9ohm,1/8W,1%	91637	5-51067
R110	360T101B	VAR, CER, 100ohm	71450	5-73101
R111	RCR07G105JR	CC,1Mohm,1/4W,5%	01121	5-10105

Table 6-16. Parts List (Horizontal Sub-Assy 9355027) (Continued)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
R112	RCR07G101JR	CC,100ohm,1/4W,5%	01121	5-10101
R113	RCR07G101JR	CC,100ohm,1/4W,5%	01121	5-10101
R114	RCR07G101JR	CC,100ohm,1/4W,5%	01121	5-10101
R115	RCR07G101JR	CC,100ohm,1/4W,5%	01121	5-10101
R116	RCR07G101JR	CC,100ohm,1/4W,5%	01121	5-10101
R117	RCR07G106JR	CC,10Mohm,1/4W,5%	01121	5-10106
R118	RCR07G106JR	CC,10Mohm,1/4W,5%	01121	5-10106
R119	RCR07G106JR	CC,10Mohm,1/4W,5%	01121	5-10106
R120	RCR07G153JR	CC,15Kohm,1/4W,5%	01121	5-10153
R121	RCR07G103JR	CC,10Kohm,1/4W,5%	01121	5-10103
R122	RCR07G101JR	CC,100ohm,1/4W,5%	01121	5-10101
R123	RN55D4020F	MF,402ohm,1/8W,1%	91637	5-51154
R124	RN55D6811F	MF,6.81Kohm,1/8W,1%	91637	5-51283
R125	RN55D2101F	MF,2.10Kohm,1/8W,1%	91637	5-51224
R126	RN55D1000F	MF,100ohm,1/8W,1%	91637	5-51096
R127	RN55D4020F	MF,402ohm,1/8W,1%	91637	5-51154
R128	RN55D5491F	MF,5.49Kohm,1/8W,1%	91637	5-51274
R129	RN55D2491F	MF,2.49Kohm,1/8W,1%	91637	5-51231
R130	RCR07G104JR	CC,100Kohm,1/4W,5%	01121	5-10104
R131	RCR07G106JR	CC,10Mohm,1/4W,5%	01121	5-10106
R132	RCR07G273JR	CC,27Kohm,1/4W,5%	01121	5-10273
R133	RCR07G202JR	CC,2Kohm,1/4W,5%	01121	5-10202
R134	RCR07G104JR	CC,100Kohm,1/4W,5%	01121	5-10104
R135	RCR07G106JR	CC,10Mohm,1/4W,5%	01121	5-10106
R136	RCR07G273JR	CC,27Kohm,1/4W,5%	01121	5-10273
R137	RCR07G202JR	CC,2Kohm,1/4W,5%	01121	5-10202
R138	RCR07G104JR	CC,100Kohm,1/4W,5%	01121	5-10104
R139	RCR07G106JR	CC,10Mohm,1/4W,5%	01121	5-10106
R140	RCR07G273JR	CC,27Kohm,1/4W,5%	01121	5-10273
R141	RCR07G202JR	CC,2Kohm,1/4W,5%	01121	5-10202
R142	RCR07G103JR	CC,10Kohm,1/4W,5%	01121	5-10103
R143	RCR07G683JR	CC,68Kohm,1/4W,5%	01121	5-10683
R144	RCR07G104JR	CC,100Kohm,1/4W,5%	01121	5-10104
R145	RCR07G104JR	CC,100Kohm,1/4W,5%	01121	5-10104
R146	RN55D1001F	MF,1.00Kohm,1/8W,1%	91637	5-51193
R147	RCR07G101JR	CC,100ohm,1/4W,5%	01121	5-10101
R148	RN55D7502F	MF,75.0Kohm,1/8W,1%	91637	5-51382
R149	360T103B	VAR, CER,10Kohm	71450	5-73103
R150	RCR07G821JR	CC,820ohm,1/4W,5%	01121	5-10821
R151	360T501B	VAR, CER, 500ohm	71450	5-73501
R152	RCR07G202JR	CC,2Kohm,1/4W,5%	01121	5-10202
R153	RN55D9091F	MF,9.09Kohm,1/8W,1%	91637	5-51295
R154	RN55D5761F	MF,5.76Kohm,1/8W,1%	91637	5-51276
R155	RN55D4320F	MF,432ohm,1/8W,1%	91637	5-51157
R156	RN55D3090F	MF,309ohm,1/8W,1%	91637	5-51143

Table 6-16. Parts List (Horizontal Sub-Assy 9355027) (Continued)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
R157	RN55D3090F	MF,309ohm,1/8W,1%	91637	5-51143
R158	RCR07G560JR	CC,56ohm,1/4W,5%	01121	5-10560
R159	RN55D8060F	MF,806ohm,1/8W,1%	91637	5-51184
R160	RN55D8060F	MF,806ohm,1/8W,1%	91637	5-51184
R161	RN55D4530F	MF,453ohm,1/8W,1%	91637	5-51159
R162	RCR07G101JR	CC,100ohm,1/4W,5%	01121	5-10101
R163	RCR07G101JR	CC,100ohm,1/4W,5%	01121	5-10101
R164	RN55D4421F	MF,4.42Kohm,1/8W,1%	91637	5-51265
R165	RN55D6340F	MF,634ohm,1/8W,1%	91637	5-51173
R166	RN55D2001F	MF,2.00Kohm,1/8W,1%	91637	5-51222
R167	RN55D2672F	MF,26.7Kohm,1/8W,1%	91637	5-51340
R168	RN55D4872F	MF,48.7Kohm,1/8W,1%	91637	5-51365
R169	RN55D7871F	MF,7.87Kohm,1/8W,1%	91637	5-51289
R170	RN55D5761F	MF,5.76Kohm,1/8W,1%	91637	5-51276
R171	RN55D4320F	MF,432ohm,1/8W,1%	91637	5-51157
R172	RN55D1330F	MF,133ohm,1/8W,1%	91637	5-51108
R173	360T202B	VAR, CER, 2Kohm	71450	5-73202
R174	RCR07G471JR	CC,470ohm,1/4W,5%	01121	5-10471
R175	RN55D1330F	MF,133ohm,1/8W,5%	91637	5-51108
R176	RN55D1211F	MF,1.21Kohm,1/8W,1%	91637	5-51201
R177	RN55D1211F	MF,1.21Kohm,1/8W,1%	91637	5-51201
R178	RN55D49R9F	MF,49.9ohm,1/8W,1%	91637	5-51067
R179	360T101B	VAR, CER, 100ohm	71450	5-73101
R180	RN55D5900F	MF,590ohm,1/8W,1%	91637	5-51170
R181	RN55D5900F	MF,590ohm,1/8W,1%	91637	5-51170
R182	RN55D3480F	MF,348ohm,1/8W,1%	91637	5-51148
R183	RN55D4531F	MF,4.53Kohm,1/8W,1%	91637	5-51266
R184	RN55D1402F	MF,14.0Kohm,1/8W,1%	91637	5-51313
R185	RCR07G106JR	CC,10Mohm,1/4W,5%	01121	5-10106
R186	RCR07G224JR	CC,220Kohm,1/4W,5%	01121	5-10224
R187	RCR07G101JR	CC,100ohm,1/4W,5%	01121	5-10101
R188	RCR07G471JR	CC,470ohm,1/4W,5%	01121	5-10471
R189	RN55D1781F	MF,1.78Kohm,1/8W,1%	91637	5-51217
R190	RN55D4751F	MF,4.75Kohm,1/8W,1%	91637	5-51268
R191	RCR07G332JR	CC,3.3Kohm,1/4W,5%	01121	5-10332
R192	RN55D1002F	MF,10.0Kohm,1/8W,1%	91637	5-51299
R193	RN55D2670F	MF,267ohm,1/8W,1%	91637	5-51137
R194	RN55D2670F	MF,267ohm,1/8W,1%	91637	5-51137
R195	RCR07G332JR	CC,3.3Kohm,1/4W,5%	01121	5-10332
R196	RCR07G101JR	CC,100ohm,1/4W,5%	01121	5-10101
R197	RCR07G471JR	CC,470ohm,1/4W,5%	01121	5-10471
R198	RN55D1781F	MF,1.78Kohm,1/8W,1%	91637	5-51217
R199	RN55D1022F	MF,10.2Kohm,1/8W,1%	91637	5-51300
R200	RN55D4751F	MF,4.75Kohm,1/8W,1%	91637	5-51268
R201	RN55D1781F	MF,1.78Kohm,1/8W,1%	91637	5-51217

Table 6-16. Parts List (Horizontal Sub-Assy 9355027) (Continued)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
R202	RCR07G471JR	CC,470ohm,1/4W,5%	01121	5-10471
R203	RCR07G101JR	CC,100ohm,1/4W,5%	01121	5-10101
R204	RCR07G332JR	CC,3.3Kohm,1/4W,5%	01121	5-10332
R205	RN55D2670F	MF,267ohm,1/8W,1%	91637	5-51137
R206	RN55D1002F	MF,10.0Kohm,1/8W,1%	91637	5-51299
R207	RN55D2670F	MF,267ohm,1/8W,1%	91637	5-51137
R208	RCR07G332JR	CC,3.3Kohm,1/4W,5%	01121	5-10332
R209	RN55D1781F	MF,1.78Kohm,1/8W,1%	91637	5-51217
R210	RCR07G471JR	CC,470ohm,1/4W,5%	01121	5-10471
R211	RCR07G101JR	CC,100ohm,1/4W,5%	01121	5-10101
R212	RN55D1541F	MF,1.54Kohm,1/8W,1%	91637	5-51211
R213	RN55D1541F	MF,1.54Kohm,1/8W,1%	91637	5-51211
R214	360T203B	VAR, CER, 20Kohm	71450	5-73203
R215	RN55D5621F	MF,5.62Kohm,1/8W,1%	91637	5-51275
R216	RCR07G271JR	CC,270ohm,1/4W,5%	01121	5-10271
R217	360T201B	VAR, CER, 200ohm	71450	5-73201
R218	RN55D6651F	MF,6.65Kohm,1/8W,1%	91637	5-51282
R219	RN55D1272F	MF,12.7Kohm,1/8W,1%	91637	5-51309
R220	RN55D1102F	MF,11.0Kohm,1/8W,1%	91637	5-51303
R221	RN55D6651F	MF,6.65Kohm,1/8W,1%	91637	5-51282
R222	RCR07G101JR	CC,100ohm,1/4W,5%	01121	5-10100
S1	9152002	Switch, Trigger	34160	2-10046
		TERMINALS		
J1	450-3366-01-03	Jack, Connector	Cambion	2-24014
J2	450-3366-01-03	Jack, Connector	Cambion	2-24014
	MP165-2	Mini-pin, .3L	PMP	2-24016
		TRANSISTORS		
Q1	2N3904	NPN, Signal	07263	3-23904
Q2	2N3906	PNP, Signal	07263	3-23906
Q3	2N3906	PNP, Signal	07263	3-23906
Q4	2N3906	PNP, Signal	07263	3-23906
Q5	2N3906	PNP, Signal	07263	3-23906
Q6	2N3906	PNP, Signal	07263	3-23906
Q7	2N3906	PNP, Signal	07263	3-23906
Q8	2N3906	PNP, Signal	07263	3-23906
Q9	2N3904	NPN, Signal	07263	3-23904
Q10	2N3904	NPN, Signal	07263	3-23904
Q11	2N3904	NPN, Signal	07263	3-23904
Q12	2N3906	PNP, Signal	07263	3-23906
Q13	2N3906	PNP, Signal	07263	3-23906
Q14	2N3906	PNP, Signal	07263	3-23906
Q15	2N3906	PNP, Signal	07263	3-23906

Table 6-16. Parts List (Horizontal Sub-Assy 9355027) (Continued)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
Q16	2N3906	PNP, Signal	07263	3-23906
Q17	2N3906	PNP, Signal	07263	3-23906
Q18	2N3904	NPN, Signal	07263	3-23904
Q19	2N3904	NPN, Signal	07263	3-23904
Q20	2N3904	NPN, Signal	07263	3-23904
Q21	2N3906	PNP, Signal	07263	3-23906
Q22	2N3906	PNP, Signal	07263	3-23906
Q23	2N3904	NPN, Signal	07263	3-23904
Q24	2N3904	NPN, Signal	07263	3-23904
Q25	2N3904	NPN, Signal	07263	3-23904
Q26	2N3904	NPN, Signal	07263	3-23904
Q27	F2701	FET, NCH	Solitron	3-22701
Q28	F2701	FET, NCH	Solitron	3-22701
Q29	2N3906	PNP, Signal	07263	3-23906
Q30	2N3906	PNP, Signal	07263	3-23906
Q31	2N3906	PNP, Signal	07263	3-23906
Q32	2N3904	NPN, Signal	07263	3-23904
Q33	2N3904	NPN, Signal	07263	3-23904
Q34	2N3904	NPN, Signal	07263	3-23904
Q35	2N3904	NPN, Signal	07263	3-23904
Q36	2N3904	NPN, Signal	07263	3-23904
Q37	2N3906	PNP, Signal	07263	3-23906
Q38	F2762	FET, NCH	Solitron	3-22762
Q39	F2762	FET, NCH	Solitron	3-22762
Q40	F2762	FET, NCH	Solitron	3-22762
Q41	F2762	FET, NCH	Solitron	3-22762
Q42	F2762	FET, NCH	Solitron	3-22762
Q43	F2762	FET, NCH	Solitron	3-22762
Q44	2N3904	NPN, Signal	07263	3-23904
Q45	2N3904	NPN, Signal	07263	3-23904
Q46	2N3904	NPN, Signal	07263	3-23904
Q47	2N3904	NPN, Signal	07263	3-23904
Q48	F2762	FET, NCH	Solitron	3-22762
Q49	F2762	FET, NCH	Solitron	3-22762
Q50	F2762	FET, NCH	Solitron	3-22762
Q51	F2762	FET, NCH	Solitron	3-22762
Q52	2N3906	PNP, Signal	07263	3-23906
Q53	2N3904	NPN, Signal	07263	3-23904
Q54	2N3906	PNP, Signal	07263	3-23906
Q55	2N3906	PNP, Signal	07263	3-23906
Q56	2N3906	PNP, Signal	07263	3-23906
Q57	2N3904	NPN, Signal	07263	3-23904
Q58	2N3904	NPN, Signal	07263	3-23904
Q59	2N3906	PNP, Signal	07263	3-23906
Q60	2N3906	PNP, Signal	07263	3-23906

Table 6-16. Parts List (Horizontal Sub-Assy 9355027) (Continued)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
Q61	2N3906	PNP, Signal	07263	3-23906
Q62	2N3904	NPN, Signal	07263	3-23904
Q63	2N3904	NPN, Signal	07263	3-23904
Q64	2N3904	NPN, Signal	07263	3-23904
Q65	F2701	FET, NCH	Solitron	3-22701
Q66	F2701	FET, NCH	Solitron	3-22701
Q67	2N5087	PNP, Signal	04713	5-25087
Q68	2N3906	PNP, Signal	07263	3-23906
Q69	2N3904	NPN, Signal	07263	3-23904
Q70	2N3906	PNP, Signal	07263	3-23906
Q71	2N3904	NPN, Signal	07263	3-23904
Q72	2N3904	NPN, Signal	07263	3-23904
Q73	2N3904	NPN, Signal	07263	3-23904
Q74	2N3906	PNP, Signal	07263	3-23906
Q75	2N5087	PNP, Signal	04713	5-25087
Q76	2N3906	PNP, Signal	07263	3-23906
Q77	2N3904	NPN, Signal	07263	3-23904
Q78	2N3904	NPN, Signal	07263	3-23904
Q79	2N3904	NPN, Signal	07263	3-23904
Q80	2N3904	NPN, Signal	07263	3-23904
Q81	2N3904	NPN, Signal	07263	3-23904
Q82	2N3904	NPN, Signal	07263	3-23904
		HARDWARE		
2 Req.	570-1510-01-0519	Standoff	Cambion	4-20199
2 Req.	MS51957-12	Screw, 4-40 X 3/16, Panhead	-	8-10012
2 Req.	MS35333-70	Washer, #4 Int. Lk.	-	8-40002

Table 6-17. Parts List (Power Supply, Batt Pack Assy 9355019)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
	9353019	Etched Circuit Board	34160	1-20099
		CAPACITORS		
C1	672D567H020DS5C	Elect, 560uf, 20V	56289	6-83567
C2	672D567H020DS5C	Elect, 560uf, 20V	56289	6-83567
C3	672D567H020DS5C	Elect, 560uf, 20V	56289	6-83567
C4	672D567H020DS5C	Elect, 560uf, 20V	56289	6-83567
C5	672D567H020DS5C	Elect, 560uf, 20V	56289	6-83567
C6	T362C106M035AS	TANT, 10uf±20%, 35V	05397	6-75106
C7	T362D476M035AS	TANT, 47uf±20%, 35V	05397	6-75476
C8	5GA-D10	CD,.001uf±20%,1KV	56289	6-20102
C9	5GA-D10	CD,.001uf±20%,1KV	56289	6-20102
C10	T362D227M010AS	TANT, 220uf±20%, 10V	05397	6-76227
C11	T362C336M020AS	TANT, 33uf±20%, 20V	05397	6-74336
C12	672D108H012DS5C	Elect, 1000uf, 12V	56289	6-82108
C13	1802Z5U050A104Z	MONO CER,.1uf+80-20%, 50V	Varadyne	6-36104
C14	1801Z5U050A223Z	MONO CER,.022uf+80-20% 50V	Varadyne	6-36223
C15	T362D337M006AS	TANT, 330uf±20%, 6V	05397	6-71337
C16	1802Z5U050A104Z	MONO CER,.1uf+80-20%, 50V	Varadyne	6-36104
C17	672D567H020DS5C	Elect, 560uf, 20V	56289	6-83567
C18	1802Z5U050A104Z	MONO CER,.1uf+80-20%, 50V	Varadyne	6-36104
C19	T362D227M010AS	TANT, 220uf±20%, 10V	05397	6-76227
C20	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C21	672D567H020DS5C	Elect, 560uf, 20V	56289	6-83567
C22	1802Z5U050A104Z	MONO CER,.1uf+80-20%, 50V	Varadyne	6-36104
C23	T362D227M010AS	TANT, 220uf±20%, 10V	05397	6-76227
C24	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C25	672D567H020DS5C	Elect, 560uf, 20V	56289	6-83567
C26	1802Z5U050A104Z	MONO CER,.1uf+80-20%, 50V	Varadyne	6-36104
C27	672D567H020DS5C	Elect, 560uf, 20V	56289	6-83567
C28	1802Z5U050A104Z	MONO CER,.1uf+80-20%, 50V	Varadyne	6-36104
C29	T362D107M020AS	TANT, 100uf±20%, 20V	05397	6-74107
C30	DDM-103	CD,.01uf+60-40%, 150V	71590	6-27103
C31	672D567H020DS5C	Elect, 560uf, 20V	56289	6-83567
C32	1802Z5U050A104Z	MONO CER,.1uf+80-20%, 50V	Varadyne	6-36104
C33	T362D107M020AS	TANT, 100uf±20%, 20V	05397	6-74107

Table 6-17. Parts List (Power Supply, Batt Pack Assy 9355019) (Continued)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
C34	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C35	T362D476M035AS	TANT,47uf±20%,35V	05397	6-75476
C36	1802Z5U050A104Z	MONO CER,.1uf+80-20%, 50V	Varadyne	6-36104
C37	T362D476M035AS	TANT,47uf±20%,35V	05397	6-75476
C38	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C39	T362D476M035AS	TANT,47uf±20%,35V	05397	6-75476
C40	1802Z5U050A104Z	MONO CER,.1uf+80-20%, 50V	Varadyne	6-36104
C41	T362D476M035AS	TANT,47uf±20%,35V	05397	6-75476
C42	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
C43	DDM-103	CD,.01uf+60-40%,150V	71590	6-27103
		CHOKES		
L1	9352059	Filter, Choke	34160	5-90101
L2	9352059	Filter, Choke	34160	5-90101
L3	9352059	Filter, Choke	34160	5-90101
L4	9352059	Filter, Choke	34160	5-90101
L5	9352059	Filter, Choke	34160	5-90101
L6	9352059	Filter, Choke	34160	5-90101
		DIODES		
CR1	MR501	Power, 3A, 100V	04713	3-10501
CR2	MR501	Power, 3A, 100V	04713	3-10501
CR3	1N4004	Power, 1A, 400V	07263	3-14004
CR4	1N4004	Power, 1A, 400V	07263	3-14004
CR5	1N4004	Power, 1A, 400V	07263	3-14004
CR6	MR501	Power, 3A, 100V	04713	3-10501
CR7	1N4004	Power, 1A, 400V	07263	3-14004
CR8	1N750A	Zener, 4.7V, ±5%	04713	3-10750
CR9	1N4004	Power, 1A, 400V	07263	3-14004
CR10	1N4004	Power, 1A, 400V	07263	3-14004
CR11	1N4004	Power, 1A, 400V	07263	3-14004
CR12	1N914	GP, Signal	07263	3-10914
CR13	1N914	GP, Signal	07263	3-10914
CR14	1N914	GP, Signal	07263	3-10914
CR15	1N914	GP, Signal	07263	3-10914
CR16	1N5232	Zener, 5.6V	04713	3-15232
CR17	1N914	GP, Signal	07263	3-10914
CR18	1N914	GP, Signal	07263	3-10914
CR19	1N4004	Power, 1A, 400V	07263	3-14004
CR20	1N4004	Power, 1A, 400V	07263	3-14004
CR21	1N4004	Power, 1A, 400V	07263	3-14004

Table 6-17. Parts List (Power Supply, Batt Pack Assy 9355019) (Continued)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
CR22	1N4004	Power, 1A, 400V	07263	3-14004
CR23	1N4004	Power, 1A, 400V	07263	3-14004
CR24	1N4004	Power, 1A, 400V	07263	3-14004
CR25	1N4004	Power, 1A, 400V	07263	3-14004
CR26	1N4004	Power, 1A, 400V	07263	3-14004
CR27	1N4004	Power, 1A, 400V	07263	3-14004
CR28	1N4004	Power, 1A, 400V	07263	3-14004
CR29	1N4004	Power, 1A, 400V	07263	3-14004
CR30	1N4004	Power, 1A, 400V	07263	3-14004
CR31	1N4004	Power, 1A, 400V	07263	3-14004
CR32	1N4004	Power, 1A, 400V	07263	3-14004
CR33	1N4004	Power, 1A, 400V	07263	3-14004
CR34	1N4004	Power, 1A, 400V	07263	3-14004
CR35	1N4004	Power, 1A, 400V	07263	3-14004
CR36	1N4004	Power, 1A, 400V	07263	3-14004
CR37	1N4004	Power, 1A, 400V	07263	3-14004
CR38	1N4004	Power, 1A, 400V	07263	3-14004
CR39	1N4004	Power, 1A, 400V	07263	3-14004
CR40	1N914	GP, Signal	07263	3-10914
CR41	1N750	Zener, 4.7V, ±5%	04713	3-10750
F3	313 005	Fuse, Slo Blo, 3AG, 5Amp	Littlefuse	2-40020
2 Req.	102068	Fuse Clips	Littlefuse	2-40019
		INTEGRATED CIRCUITS		
U1	LM301	OP, Amp	Nat'l	3-30301
U2	LM301	OP, Amp	Nat'l	3-30301
		RESISTORS		
R1	RCR07G392JR	CC,3.9Kohm,1/4W,5%	01121	5-10392
R2	TYPE BWH	WW,.47ohm,2W,5%	TRW	5-30047
R3	RCR42G111JR	CC,110ohm,2W,5%	01121	5-40111
R4	-	TBD	-	-
R5	RCR20G1R0JR	CC,1ohm,1/2W,5%	01121	5-20010
R6	RCR07G122JR	CC,1.2Kohm,1/4W,5%	01121	5-10122
R7	RN55D8251F	MF,8.25Kohm,1/8W,1%	91637	5-51291
R8	360T202B	VAR, CER, 2Kohm	71450	5-73202
R9	RN55D2741F	MF,2.74Kohm,1/8W,1%	91637	5-51235
R10	RCR07G101JR	CC,100ohm,1/4W,5%	01121	5-10101
R11	RCR07G123JR	CC,12Kohm,1/4W,5%	01121	5-10123
R12	RN55D5112F	MF,51.1Kohm,1/8W,1%	91637	5-51367

Table 6-17. Parts List (Power Supply, Batt Pack Assy 9355019) (Continued)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
R13	360T103B	VAR, CER, 10Kohm	71450	5-73103
R14	RN55D3922F	MF,39.2Kohm,1/8W,1%	91637	5-51356
R15	RCR07G102JR	CC,1Kohm,1/4W,5%	01121	5-10102
R16	RCR32G270JR	CC,27ohm,1W,5%	01121	5-30270
R17	RCR32G270JR	CC,27ohm,1w,5%	01121	5-30270
R18	RCR20G150JR	CC,15ohm,1/2W,5%	01121	5-20150
R19	TYPE BWH	WW,.47ohm,2W,5%	TRW	5-30047
		TRANSFORMERS		
T1	9352060-1	Toroid, Driver	34160	7-61025
T2	9352060-3	Inverter Batt Pack	34160	7-61026
T3	9352061	Power, Batt Pack	34160	7-61027
		TRANSISTORS		
Q1	D44H2	NPN, Power	G.E.	3-24442
Q2[1]	D44H2	NPN, Power	G.E.	3-24442
Q3	2N3694	NPN, Signal	07263	3-23694
Q4	TIP33	NPN, Power	01294	3-20033
Q5	TIP33	NPN, Power	01294	3-20033
Q6	D44H2	NPN, Power	G.E.	3-24442
Q7[1]	D44H2	NPN, Power	G.E.	3-24442
	9352080	Decal,calibrate	34160	4-20312
	9352079	Decal, Serial No.	34160	4-20311
S1	7203W/J Rocker	Switch, DPDT	C & K	2-10031
J8	2142-0	Banana Jack, Black	Pomona	4-20157
J9	2142-2	Banana Jack, Red	Pomona	4-20158
	9352064	Power Supply, Chassis	34160	1-10798
	9352065	P.S. Heatsink, Batt Pack	34160	1-10799
	9352024	Transformer Bracket	34160	1-10777
2 Req.	9352029	Power Supply Support Bracket	34160	1-10778
	9352032	Power Supply Cover	34160	1-10779
	9352056	Heatsink, Batt Pack	34160	1-10800
	9342066	Heatsink Mount, Batt Pack	34160	1-10801
4 Req.	F6B	Feet, Cabinet	Budwig	4-20177
J7	6J1	Voltage Selector and Fused Conn	Corcom	2-40015

[1]Mounts on heatsink 9352056

Table 6-17. Parts List (Power Supply, Batt Pack Assy 9355019) (Continued)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
J1	03-06-1151	Connector, Receptacle	Molex	2-24019
15 Req.	02-06-1103	Terminal, Female	Molex	2-24020
F1*	313.500	Fuse, S.B. 3AG, 1/2Amp	Littlefuse	2-40017
*	313.250	Fuse, S.B. 3AG, 1/4Amp	Littlefuse	2-40004
9 Req.	MS24693-2	Screw, 4-40 X 1/4, Flathead	-	8-20013
5 Req.	MS51957-13	Screw, 4-40 X 1/4, Panhead	-	8-10013
4 Req.	MS51957-51	Screw, 8-32 X 1 1/2, Panhead S.S.	-	8-10051
2 Req.	MS24693-4	Screw, 4-40 X 3/8, Flathead	-	8-20015
4 Req.	MS51957-30	Screw, 6-32 X 1/2, Panhead	-	8-10030
2 Req.	MS51957-20	Screw, 4-40 X 7/8, Panhead	-	8-10020
2 Req.	NAS671C8	Nut, 8-32	-	8-30007
10 Req.	NAS671C4	Nut, 4-40	-	8-30005
4 Req.	MS35333-72	Washer, #8 Int. Lk	-	8-40004
9 Req.	MS35333-70	Washer, #4 Int. Lk	-	8-40002
3 Req.	7403-09FR-51	Sil-Pads 400	Berquist	4-20290
5 Req.	DF-137A	Washer, Insulating	86684	8-60003
2 Req.	7403-09FR-53	Sil-Pads 400	Berquist	4-20291
4 Req.	MS35333-71	Washer, #6 Int. Lk.	-	8-40003
6 Req.	2634-21650-N171	Washer, Nylon Shoulder	Amatom	8-60009
2 Req.	2516	Washer, Nylon Flat	83330	8-60010

* For 115V operation use 1/2 Amp; 230V operation use 1/4 Amp.

Table 6-18. Parts List (935 Battery Pack Option Assy 9355020)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
	9352062	Battery Tray	34160	1-10802
	9152031	Battery Strap-Rear	34160	1-10732
2 Req.	9152039	Foot Arch	34160	1-10733
	9352063	Battery Cover	34160	1-10803
	9152041	Battery Strap-Front	34160	1-10735
	9402103	Battery Caution Decal	34160	4-20255
	9152040	Bottom Panel Decal	34160	4-20248
2 Req.	NP6-6	Battery, 6 Volt, 6 Amp Hr	Yuasa	4-20320
	2244 Black	Miniature Banana Plug	Pomona	2-24012
6 Req.	F6B	Cabinet Foot, Black	Budwig	4-20177
12in	—	1/4 Thick X 3/8 Wide foam W/Adhes	-	4-20293
2 Req.	4056	Nylon Spacer, 1/4 O.D. X 1/2, 4-40 Taps	83330	4-20250
2 Req.	—	Nylon Screw, 4-40 X 3/16 Flat	Gries	8-90002
A/R	18 AWG	Wire, Black and Red		
4 Req.	MS51957-27	Screw, 6-32 X 5/16, Panhead	-	8-10027
10 Req.	MS35333-71	Washer, #6, Int. Lk	-	8-40003
4 Req.	MS24693-2	Screw, 4-40 X 1/4, Flathead	-	8-20013
4 Req.	MS51957-13	Screw, 4-40 X 1/4, Panhead	-	8-10013
6 Req.	MS51957-30	Screw, 6-32 X 1/2, Panhead	-	8-10030
6 Req.	NAS671C6	Nut, 6-32	-	8-30006
4 Req.	MS35333-70	Washer, #4, Int. Lk	-	8-40002

Table 6-19. Parts List (Final Assy Batt Pack 9355021)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
		Same as 9355015 Final Assy(-1 and/or-3) except for following:		
		DELETE		
	9355007	Power Supply Assy	34160	
		ADD		
	9355019	Power Supply Batt Pack Assy	34160	
	9355020	Battery Pack Assy	34160	

Table 6-21. Parts List (PS950 CRT-Telefunken 9355024)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
	Following changes pertain to Main Chassis Sub-Assy, 9355013 or Main Chassis Sub-Assy 9505007			
		Delete		
V1	D10-293	CRT w/graticule	Brimar	3-40014
L1	9352077	Trace Angle Coil	34160	5-90102
		Add		
V1	D10-650	CRT W/Graticule	Telefunken	3-40015
	212-NN-0101	Flanged Bushing	Plasti Glide	2-45009
	2678	Washer, Nylon Flat	83330	8-60008
	Following changes pertain to 6KV High Voltage Sub-Assy, 9355025			
		Delete		
R13	RCR07G395JR	CC,3.9Mohm,¼W,5%	01121	5-10395
R19	360T105B	Var,Cer,1Mohm	71450	5-73105
		Add		
R13	RCR07GU34JR	CC,430Kohm,¼W,5%	01121	5-10434
R19	360T504B	Var,Cer,500Kohm	71450	5-73504
	Following change pertains to Interconnect Sub-Assy 9355014 or Interconnect Sub-Assy 9505006			
		Delete		
XV1	B12FN	CRT Socket	Brimar	2-60010
		Add		
XV1	003-509	CRT Socket	Telefunken	2-60015

Table 6-21. Parts List (Handle Assy 9405070)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
2 Req.	9402094	Handle Support	34160	1-10694
2 Req.	9402095	Handle Arm	34160	1-10695
2 Req.	9402096	Handle Cover	34160	1-10696
1 Req.	9402100	Handle Grip	34160	1-10698
1 Req.	9402098	Handle Decal	34160	4-20236
		HARDWARE		
2 Req.	Blk oxide treated	Screw,6-32 x 11/16FlatHd.	-	8-90004
2 Req.	22Ft - 632	Nut,LK 6-32, Thin Height	SPS	8-90003
2 Req.	LC-032D-1MusicWire	Compression Spg..300x7/16	Lee Spring	4-20237
4 Req.	MS24693-47	Screw, 8-32x5/16, Flat Hd	-	8-20042

Table 6-22. Parts List (DMM-Counter Sub-Assy 9755001)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
	9753001	Etched Circuit Board	34160	1-20088
		CAPACITORS		
C1	C4003/1B	Var, Mica, 4-45Pf	84171	6-96004
C2	DDM-103	CD,.01uf+60%-40%,150V	71590	6-27103
C3	T362D107M020AS	TANT,100uf±20%,20V	05397	6-74107
C4	1802Z5U050A104Z	MONO CER,.1uf+80%-20%, 50V	Varadyne	6-36104
C5	1802Z5U050A104Z	MONO CER,.1uf+80%-20%, 50V	Varadyne	6-36104
C6	DM15-150J	DM,15Pf±5%,500V	04062	6-19150
C7	1802Z5U050A104Z	MONO CER,.1uf+80%-20%, 50V	Varadyne	6-36104
C8	1802Z5U050A104Z	MONO CER,.1uf+80%-20%, 50V	Varadyne	6-36104
C9	1802Z5U050A104Z	MONO CER,.1uf+80%-20%, 50V	Varadyne	6-36104
C10	DM15-471J	DM,470Pf±5%,500V	04062	6-19471
C11	1801Z5U050A223Z	MONO CER,.022+80%-20%, 50V	Varadyne	6-36223
C12	1802Z5U050A104Z	MONO CER,.1uf+80%-20%, 50V	Varadyne	6-36104
C13	D155F560J	DM,56Pf±5%,500V	00853	6-19560
C14	D155F560J	DM,56Pf±5%,500V	00853	6-19560
C15	DDM-103	CD,.01uf+60%-40%,150V	71590	6-27103
C16	5GA-S10	CD,.01uf±20%,1KV	56289	6-29053
C17	T362C336M020AS	TANT,33uf±20%,20V	05397	6-74336
C18	1802Z5U050A104Z	MONO CER,.1uf+80%-20%, 50V	Varadyne	6-36104
C19	T362C336M020AS	TANT,33uf±20%,20V	05397	6-74336
C20	DDM-103	CD,.01uf+60%-40%,150V	71590	6-27103
C21	DDM-103	CD,.01uf+60%-40%,150V	71590	6-27103
C22	T362C336M020AS	TANT,33uf±20%,20V	05397	6-74336
C23	DM15-100J	DM,10Pf±5%,500V	04062	6-19100
C24	DM15-150J	DM,15Pf±5%,500V	04062	6-19150
C25	DM15-330J	DM,33Pf±5%,500V	04062	6-19330
C26	DDM-103	CD,.01uf+60%-40%,150V	71590	6-27103
C27	DDM-103	CD,.01uf+60%-40%,150V	71590	6-27103
C28	T362C226M035AS	TANT,22uf±20%,35V	05397	6-75226
C29	T362C476M020AS	TANT,47uf±20%,20V	05397	6-74476
C30	D155F560J	DM,56Pf±5%,500V	00853	6-19560
C31	DDM-103	CD,.01uf+60%-40%,150V	71590	6-27103
C32	DDM-103	CD,.01uf+60%-40%,150V	71590	6-27103
C33	XA2A223J	MM,.022±5%,50V	27556	6-46223

Table 6-22. Parts List (DMM-Counter Sub-Assy 9755001) (Continued)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
C34	XA2A153J	MM,.015±5%,50V	27556	6-46153
C35	XA2A104J	MM,.1uf±5%,50V	27556	6-46104
C36	C4003/1B	VAR,MICA,4-45Pf	84171	6-96004
C37	1802Z5U050A105Z	MONO CER,.1uf+80%-20%, 50V	Varadyne	6-36104
C38	1802Z5U050A104Z	MONO CER,.1uf+80%-20%, 50V	Varadyne	6-36104
C39	1802Z5U050A104Z	MONO CER,.1uf+80%-20%, 50V	Varadyne	6-36104
C40	T362B475M020AS	TANT,4.7uf±20%,20V	05397	6-74475
C41	DDM-103	CD,.01uf+60%-40%,150V	71590	6-27103
C42	T362B475M020AS	TANT,4.7uf±20%,20V	05397	6-74475
C43	1802Z5U050A104Z	MONO CER,.1uf+80%-20%, 50V	Varadyne	6-36104
C44	DDM-103	CD,.01uf+60%-40%,150V	71590	6-27103
C45	T362D107M020AS	TANT,100uf±20%,20V	05397	6-74107
C46	DDM-103	CD,.01uf+60%-40%,150V	71590	6-27103
C47	T362D107M020AS	TANT,100uf±20%,20V	05397	6-74107
C48	1802Z5U050A104Z	MonoCer,.1uf+80-20%,50V	Varadyne	6-36104
C49	T362D337M006AS	TANT,330uf±20%,6V	05397	6-71337
C50	1802Z5U050A104Z	MONO CER,.1uf+80%-20%, 50V	Varadyne	6-36104
C51	1802Z5U050A104Z	MONO CER,.1uf+80%-20%, 50V	Varadyne	6-36104
C52	C4003/1B	VAR,MICA,4-45Pf	84171	6-96004
C53	T362B226M010AS	TANT,22uf±20%,10V	05397	6-72226
Y1	MC-18A	Crystal, 3.2768MHZ	Monitor Labs	4-20241
		DIODES		
CR1	MBD701	Schottky	04713	3-10701
CR2	1N914	GP, Signal	07263	3-10914
CR3	1N914	GP, Signal	07263	3-10914
CR4	1N914	GP, Signal	07263	3-10914
CR5	1N914	GP, Signal	07263	3-10914
CR6	N914	GP, Signal	07263	3-10914
CR7	N914	GP, Signal	07263	3-10914
CR8	N914	GP, Signal	07263	3-10914
CR9	1N4576	Zener 6.4V	04713	3-14576
CR10	1N914	GP, Signal	07263	3-10914
CR11	FD300	Low Leakage	07263	3-10300
CR12	FD300	Low Leakage	07263	3-10300

Table 6-22. Parts List (DMM-Counter Sub-Assy 9755001) (Continued)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
CR13	FD300	Low Leakage	07263	3-10300
CR14	FD300	Low Leakage	07263	3-10300
CR15	1N914	GP, Signal	07263	3-10914
CR16	1N914	GP, Signal	07263	3-10914
CR17	1N914	GP, Signal	07263	3-10914
CR18	1N914	GP, Signal	07263	3-10914
CR19	1N914	GP, Signal	07263	3-10914
CR20	1N914	GP, Signal	07263	3-10914
CR21	1N914	GP, Signal	07263	3-10914
CR22	1N914	GP, Signal	07263	3-10914
CR23	1N914	GP, Signal	07263	3-10914
CR24	1N914	GP, Signal	07263	3-10914
CR25	1N914	GP, Signal	07263	3-10914
CR26	1N914	GP, Signal	07263	3-10914
CR27	FD300	Low Leakage	07263	3-10300
CR28	FD300	Low Leakage	07263	3-10300
CR29	IN914	GP, Signal	07263	3-10914
CR30	1N5239B	Zener, 9.1V	04713	3-15239
CR31	1N914	GP, Signal	07263	3-10914
CR32	1N914	GP, Signal	07263	3-10914
CR33	1N914	GP, Signal	07263	3-10914
CR34	1N914	GP, Signal	07263	3-10914
CR35	1N914	GP, Signal	07263	3-10914
CR36	1N914	GP, Signal	07263	3-10914
CR37	1N914	GP, Signal	07263	3-10914
		INTEGRATED CIRCUITS		
U1	SN74196N	Counter, Decade	01294	3-34196
U2	SN74LS196N	Counter, Decade	01294	3-37196
U3	SN74L90N	Counter, Decade	01294	3-34490
U4	SN74LS76N	Flip-Flop,Dual	01294	3-34476
U5	SN74LS02N	Gate, Nor	01294	3-37402
U6	SN74L10N	Gate, Nand	01294	3-37410
U7	SN74L90N	Counter, Decade	01294	3-34490
U8	SN74L90N	Counter, Decade	01294	3-34490
U9	LM318	OP, Amp	Nat'l	3-30318
U10	MK5007P	Counter, 4 Digit	Mostek	3-35007
U11	MC14511CP	Decoder Driver	04713	3-34511
U12	LM301	OP, Amp	Nat'l	3-30301
U13	SN74LS02N	Gate, Nor	01294	3-37402
U14	SN74L20N	Gand, Nand	02194	3-34420
U15	SN7416N	Hex Inverter Buffer, Driver	01294	3-37416
U16	LD111	A to D Converter	Siliconix	3-30111

Table 6-22. Parts List (DMM-Counter Sub-Assy 9755001) (Continued)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
U17	SN74L96N	Gate, Nand	01294	3-34496
U18	SN74LS02N	Gate, Nor	01294	3-37402
U19	NE555V	Timer	Signetics	3-30555
U20	MC14511CP	Decoder Driver	04713	3-34511
U21	LD110	A to D Converter	Siliconix	3-30110
U22	SN74L90N	Counter, Decade	01294	3-34490
U23	SN74LS76N	Flip-Flop, Dual	01294	3-34476
U24	MC14020CP	Counter, Binary	04713	3-34020
U25	LM301	OP, Amp	Nat'l	3-30301
U26	FD1753	Dual Fet	Solitron	3-21753
U27	LM301	OP, Amp	Nat'l	3-30301
U28	FD1753	Dual Fet	Solitron	3-21753
U29	LM318	OP, Amp	Nat'l	3-30318
DS1	DL-34M	Led Display	Litronix	3-10234
DS2	TIL-209	Indicator Light	01294	3-10209
DS3	DL-34M	Led Display	Litronix	3-10234
		RESISTORS		
R1	RN55D3321F	MF,3.32Kohm,1/8W,1%	91637	5-51243
R2	RN55D2211F	MF,2.21Kohm,1/8W,1%	91637	5-51226
R3	RCR07G102JR	CC,1Kohm,1/4W,5%	01121	5-10102
R4	RCR07G101JR	CC,100ohm,1/4W,5%	01121	5-10101
R5-N	RN55D1101F	MF,1.10Kohm,1/8W,1%	91637	5-51197
R6	RCR07G101JR	CC,100ohm,1/4W,5%	01121	5-10101
R7	RCR07G102JR	CC,1Kohm,1/4W,5%	01121	5-10102
R8	RCR07G103JR	CC,10Kohm,1/4W,5%	01121	5-10103
R9	RCR07G162JR	CC,1.6Kohm,1/4W,5%	01121	5-10162
R10	RCR07G471JR	CC,470ohm,1/4W,5%	01121	5-10471
R11	RCR07G102JR	CC,1Kohm,1/4W,5%	01121	5-10102
R12	RCR07G472JR	CC,4.7Kohm,1/4W,5%	01121	5-10472
R13	RCR07G473JR	CC,47Kohm,1/4W,5%	01121	5-10473
R14	RCR07G102JR	CC,1Kohm,1/4W,5%	01121	5-10102
R15	RCR07G100JR	CC,10ohm,1/4W,5%	01121	5-10100
R16	RCR07G100JR	CC,10ohm,1/4W,5%	01121	5-10100
R17	RCR07G103JR	CC,10Kohm,1/4W,5%	01121	5-10103
R18	RCR07G472JR	CC,4.7Kohm,1/4W,5%	01121	5-10472
R19	RCR07G473JR	CC,47Kohm,1/4W,5%	01121	5-10473
R20	RCR07G473JR	CC,47Kohm,1/4W,5%	01121	5-10473
R21	RCR07G103JR	CC,10Kohm,1/4W,5%	01121	5-10103
R22	RCR07G472JR	CC,4.7Kohm,1/4W,5%	01121	5-10472
R23	RCR07G473JR	CC,47Kohm,1/4W,5%	01121	5-10473
R24	RCR07G273JR	CC,27Kohm,1/4W,5%	01121	5-10273

-N Indicates Nominal Value

Table 6-22. Parts List (DMM-Counter Sub-Assy 9755001) (Continued)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
R25	RCR07G100JR	CC,10ohm,1/4W,5%	01121	5-10100
R26	RCR07G472JR	CC,4.7Kohm,1/4W,5%	01121	5-10472
R27	RCR07G472JR	CC,4.7Kohm,1/4W,5%	01121	5-10472
R28	RCR07G472JR	CC,4.7Kohm,1/4W,5%	01121	5-10472
R29	RCR07G472JR	CC,4.7Kohm,1/4W,5%	01121	5-10472
R30	RCR07G473JR	CC,47Kohm,1/4W,5%	01121	5-10473
R31	RCR07G473JR	CC,47Kohm,1/4W,5%	01121	5-10473
R32	RCR07G473JR	CC,47Kohm,1/4W,5%	01121	5-10473
R33	RCR07G473JR	CC,47Kohm,1/4W,5%	01121	5-10473
R34	RCR07G223JR	CC,22Kohm,1/4W,5%	01121	5-10223
R35	RCR07G223JR	CC,22Kohm,1/4W,5%	01121	5-10223
R36	RCR07G223JR	CC,22Kohm,1/4W,5%	01121	5-10223
R37	RCR07G223JR	CC,22Kohm,1/4W,5%	01121	5-10223
R38	RCR07G103JR	CC,10Kohm,1/4W,5%	01121	5-10103
R39	RCR07G103JR	CC,10Kohm,1/4W,5%	01121	5-10103
R40	RCR07G103JR	CC,10Kohm,1/4W,5%	01121	5-10103
R41	RCR07G103JR	CC,10Kohm,1/4W,5%	01121	5-10103
R42	RCR07G124JR	CC,120Kohm,1/4W,5%	01121	5-10124
R43	RCR07G681JR	CC,680ohm,1/4W,5%	01121	5-10681
R44	RCR07G681JR	CC,680ohm,1/4W,5%	01121	5-10681
R45	RCR07G681JR	CC,680ohm,1/4W,5%	01121	5-10681
R46	RCR07G681JR	CC,680ohm,1/4W,5%	01121	5-10681
R47	RCR07G681JR	CC,680ohm,1/4W,5%	01121	5-10681
R48	RCR07G681JR	CC,680ohm,1/4W,5%	01121	5-10681
R49	RCR07G681JR	CC,680ohm,1/4W,5%	01121	5-10681
R50	RCR07G122JR	CC,1.2Kohm,1/4W,5%	01121	5-10122
R51	RCR07G104JR	CC,100Kohm,1/4W,5%	01121	5-10104
R52	RCR07G103JR	CC,10Kohm,1/4W,5%	01121	5-10103
R53	RCR07G681JR	CC,680ohm,1/4W,5%	01121	5-10681
R54	RN55D3010F	MF,301ohm,1/8W,1%	91637	5-51142
R55	RCR07G754JR	CC,750Kohm,1/4W,5%	01121	5-10754
R56	RN55D6341F	MF,6.34Kohm,1/8W,1%	91637	5-51280
R57	360T201B	VAR, CER, 200ohm	71450	5-73201
R58	RN55D4990F	MF,499ohm,1/8W,1%	91637	5-51163
R59	RN55D7681F	MF,7.68Kohm,1/8W,1%	91637	5-51288
R60	360T102B	VAR, CER, 1Kohm	71450	5-73102
R61	RN55D4872F	MF,48.7Kohm,1/8W,1%	91637	5-51365
R62	RCR07G683JR	CC,68Kohm,1/4W,5%	01121	5-10683
R63	RCR07G683JR	CC,68Kohm,1/4W,5%	01121	5-10683
R64	RN60D1004F	MF,1Mohm,1/4W,1%	91637	5-50490
R65	RN55D1073F	MF,107Kohm,1/8W,1%	91637	5-51397
R66	360T103B	VAR, CER, 10Kohm	71450	5-73103
R67	RCR07G224JR	CC,220Kohm,1/4W,5%	01121	5-10224
R68	RN55D9761F	MF,9.76Kohm,1/8W,1%	91637	5-51298
R69	360T102B	VAR, CER, 1Kohm	71450	5-73102

Table 6-22. Parts List (DMM-Counter Sub-Assy 9755001) (Continued)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
R70	RCR07G224JR	CC,220Kohm,1/4W,5%	01121	5-10224
R71	RN55D9090F	MF,909ohm,1/8W,1%	91637	5-51189
R72	360T101B	VAR, CER, 100ohm	71450	5-73101
R73	RCR07G224JR	CC,220Kohm,1/4W,5%	01121	5-10224
R74	P57036	Thermistor	Nl Ind.	5-81001
R75	RCR07G106JR	CC,10Mohm,1/4W,5%	01121	5-10106
R76	PME70T2	MF,10Mohm,1W,1%	Pyrofilm	5-59002
R77	RCR07G101JR	CC,100ohm,1/4W,5%	01121	5-10101
R78	RN55D6812F	MF,68.1Kohm,1/8W,1%	91637	5-51378
R79	RCR07G101JR	CC,100ohm,1/4W,5%	01121	5-10101
R80	RN55D6812F	MF,68.1Kohm,1/8W,1%	91637	5-51378
R81	RCR07G103JR	CC,10Kohm,1/4W,5%	01121	5-10103
R82	RCR07G225JR	CC,2.2Mohm,1/4W,5%	01121	5-10225
R83	360T504B	VAR, CER, 500Kohm	71450	5-73504
R84	RCR07G100JR	CC,10ohm,1/4W,5%	01121	5-10100
R85	RCR07G822JR	CC,8.2Kohm,1/4W,5%	01121	5-10822
R86	RCR07G100JR	CC,10ohm,1/4W,5%	01121	5-10100
R87	PME70T2	MF,10Mohm,1W,1%	Pyrofilm	5-59002
R88	RN60D1004F	MF,1Mohm,1/4W,1%	91637	5-50490
R89	360T254B	VAR, CER, 250Kohm	71450	5-73254
R90	RN55D9762F	MF,97.6Kohm,1/8W,1%	91637	5-51393
R91	360T103B	VAR, CER, 10Kohm	71450	5-73103
R92	RN55D9531F	MF,9.53Kohm,1/8W,1%	91637	5-51297
R93	360T102B	VAR, CER, 1Kohm	71450	5-73102
R94	RCR07G105JR	CC,1Mohm,1/4W,5%	01121	5-10105
R95	360T504B	VAR, CER, 500Kohm	71450	5-73504
R96	RCR07G105JR	CC,1Mohm,1/4W,5%	01121	5-10105
R97	RN55D7870F	MF,1.58Kohm,1/8W,1%	91637	5-51212
R98	RN55D3161F	MF,3.16Kohm,1/8W,1%	91637	5-51241
R99	RN55D3161F	MF,3.16Kohm,1/8W,1%	91637	5-51241
R100	RCR07G124JR	CC,120Kohm,1/4W,5%	01121	5-10124
R101	RN55D3161F	MF,3.16Kohm,1/8W,1%	91637	5-51241
R102	RN55D1581F	MF,1.58Kohm,1/8W,1%	91637	5-51212
R103	360T504B	VAR, CER, 500Kohm	71450	5-73504
R104	RCR07G155JR	CC,1.5Mohm,1/4W,5%	01121	5-10155
R105	RCR07G124JR	CC,120Kohm,1/4W,5%	01121	5-10124
R106	RN55D3401F	MF,3.40Kohm,1/8W,1%	91637	5-51244
R107	RN55D1071F	MF,1.07Kohm,1/8W,1%	91637	5-51196
R108	360T201B	VAR, CER, 200ohm	71450	5-73201
R109	RCR07G124JR	CC,120Kohm,1/4W,5%	01121	5-10124
R110	RCR07G470JR	CC,47ohm,1/4W,5%	01121	5-10470
R111	RCR07G104JR	CC,100Kohm,1/4W,5%	01121	5-10104
R112	RCR07G106JR	CC,10Mohm,1/4W,5%	01121	5-10106
R113	RCR07G470JR	CC,47ohm,1/4W,5%	01121	5-10470
R114	RCR07G106JR	CC,10Mohm,1/4W,5%	01121	5-10106

Table 6-22. Parts List (DMM-Counter Sub-Assy 9755001) (Continued)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
R115	RCR07G104JR	CC,100Kohm,1/4W,5%	01121	5-10104
R116	RCR07G822JR	CC,8.2Kohm,1/4W,5%	01121	5-10822
R117	RCR07G512JR	CC,5.1Kohm,1/4W,5%	01121	5-10512
R118	RCR07G222JR	CC,2.2Kohm,1/4W,5%	01121	5-10222
R119	RCR07G124JR	CC,120Kohm,1/4W,5%	01121	5-10124
R120	RCR07G124JR	CC,120Kohm,1/4W,5%	01121	5-10124
R121	RCR07G124JR	CC,120Kohm,1/4W,5%	01121	5-10124
R122	RCR07G473JR	CC,47Kohm,1/4W,5%	01121	5-10473
R123	RCR07G103JR	CC,10Kohm,1/4W,5%	01121	5-10103
R124	RCR07G473JR	CC,47Kohm,1/4W,5%	01121	5-10473
R125	RCR07G103JR	CC,10Kohm,1/4W,5%	01121	5-10103
R126	RCR07G473JR	CC,47Kohm,1/4W,5%	01121	5-10473
R127	RCR07G103JR	CC,10Kohm,1/4W,5%	01121	5-10103
R128	RCR07G473JR	CC,47Kohm,1/4W,5%	01121	5-10473
R129	RCR07G473JR	CC,47Kohm,1/4W,5%	01121	5-10473
R130	RCR07G472JR	CC,4.7Kohm,1/4W,5%	01121	5-10472
R131	RCR07G103JR	CC,10Kohm,1/4W,5%	01121	5-10103
R132	RCR07G822JR	CC,8.2Kohm,1/4W,5%	01121	5-10822
R133	RCR07G512JR	CC,5.1Kohm,1/4W,5%	01121	5-10512
R134	RCR07G222JR	CC,2.2Kohm,1/4W,5%	01121	5-10222
R135	RN55D1003F	MF,100Kohm,1/8W,1%	91637	5-51394
R136	RN55D7872F	MF,78.7Kohm,1/8W,1%	91637	5-51384
R137	RN55D9092F	MF,90.9Kohm,1/8W,1%	91637	5-51390
R138	RCR07G105JR	CC,1Mohm,1/4W,5%	01121	5-10105
R139	RCR07G105JR	CC,1Mohm,1/4W,5%	01121	5-10105
R140	360T203B	VAR, CER, 20Kohm	71450	5-73203
R141	RN55D7502F	MF,75.0Kohm,1/8W,1%	91637	5-51382
R142	RCR07G203JR	CC,20Kohm,1/4W,5%	01121	5-10203
R143	RCR07G472JR	CC,4.7Kohm,1/4W,5%	01121	5-10472
R144	RCR07G332JR	CC,3.3Kohm,1/4W,5%	01121	5-10332
R145	RCR07G332JR	CC,3.3Kohm,1/4W,5%	01121	5-10332
R146	RCR07G332JR	CC,3.3Kohm,1/4W,5%	01121	5-10332
R147	RCR07G332JR	CC,3.3Kohm,1/4W,5%	01121	5-10332
R148	RCR07G301JR	CC,300ohm,1/4W,5%	01121	5-10301
R149	RCR07G124JR	CC,120Kohm,1/4W,5%	01121	5-10124
R150	RCR07G681JR	CC,680ohm,1/4W,5%	01121	5-10681
R151	RCR07G681JR	CC,680ohm,1/4W,5%	01121	5-10681
R152	RCR07G681JR	CC,680ohm,1/4W,5%	01121	5-10681
R153	RCR07G681JR	CC,680ohm,1/4W,5%	01121	5-10681
R154	RCR07G681JR	CC,680ohm,1/4W,5%	01121	5-10681
R155	RCR07G681JR	CC,680ohm,1/4W,5%	01121	5-10681
R156	RCR07G681JR	CC,680ohm,1/4W,5%	01121	5-10681
R157	RCR07G472JR	CC,4.7Kohm,1/4W,5%	01121	5-10472
R158	RCR07G511JR	CC,510ohm,1/4W,5%	01121	5-10511
R159	RCR07G510JR	CC,51ohm, 1/4W,5%	01121	5-10510
R160	RCR07G393JR	CC,39Kohm,1/4W,5%	01121	5-10393

Table 6-22. Parts List (DMM-Counter Sub-Assy 9755001) (Continued)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
R161	RCR07G510JR	CC,51ohm,1/4W,5%	01121	5-10510
R162	RCR07G122JR	CC,1.2Kohm,1/4W,5%	01121	5-10122
R163	RCR07G104JR	CC,100Kohm,1/4W,5%	01121	5-10104
R164	RCR07G103JR	CC,10Kohm,1/4W,5%	01121	5-10103
R165	RCR07G100JR	CC,10ohm,1/4W,5%	01121	5-10100
R166	RCR07G100JR	CC,10ohm,1/4W,5%	01121	5-10100
R167	RCR20G1R0JR	CC,1ohm,1/2W,5%	01121	5-20010
R168	RCR07G103JR	CC,10Kohm,1/4W,5%	01121	5-10103
R169	RCR07G473JR	CC,47Kohm,1/4W,5%	01121	5-10473
R170	RCR07G106JR	CC,10Mohm,1/4W,5%	01121	5-10106
S1	9752001	Switch, Counter Range	34160	2-10048
S2	9752010	Switch, DMM Function	34160	2-10049
		TERMINALS		
TP1	MP170-2	Mini-Pin, .6 Long	PMP	2-24015
TP2	MP170-2	Mini-Pin, .6 Long	PMP	2-24015
TP3	MP170-2	Mini-Pin, .6 Long	PMP	2-24015
P1	MP165-2	Mini-Pin, .3 Long	PMP	2-24016
P2	MP165-2	Mini-Pin, .3 Long	PMP	2-24016
J3	450-3366-01-03	Jack, Connector	Cambion	2-24014
J4	450-3366-01-03	Jack, Connector	Cambion	2-24014
	MP170-2	Mini-Pin, .6 Long	PMP	2-24015
	MP170-2	Mini-Pin, .6 Long	PMP	2-24015
		TRANSISTORS		
Q1	2N3904	NPN, Signal	04713	3-23904
Q2	2N3904	NPN, Signal	04713	3-23904
Q3	2N3906	PNP, Signal	04713	3-23906
Q4	2N3904	NPN, Signal	04713	3-23904
Q5	2N3904	NPN, Signal	04713	3-23904
Q6	2N3904	NPN, Signal	04713	3-23904
Q7	2N3904	NPN, Signal	04713	3-23904
Q8	2N3904	NPN, Signal	04713	3-23904
Q9	2N3904	NPN, Signal	04713	3-23904
Q10	2N3904	NPN, Signal	04713	3-23904
Q11	2N3904	NPN, Signal	04713	3-23904
Q12	2N3904	NPN, Signal	04713	3-23904
Q13	2N3904	NPN, Signal	04713	3-23904
Q14	2N3904	NPN, Signal	04713	3-23904
Q15	2N3904	NPN, Signal	04713	3-23904

Table 6-22. Parts List (DMM-Counter Sub-Assy 9755001) (Continued)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
Q16	2N3906	PNP, Signal	04713	3-23906
Q17	UC410	FET	Solitron	3-20410
Q18	F2701	FET, N, CH	Solitron	3-22701
Q19	F2701	FET, N, CH	Solitron	3-22701
Q20	F2701	FET, N, CH	Solitron	3-22701
Q21	F2701	FET, N, CH	Solitron	3-22701
Q22	F2701	FET, N, CH	Solitron	3-22701
Q23	F2701	FET, N, CH	Solitron	3-22701
Q24	F2701	FET, N, CH	Solitron	3-22701
Q25	2N3904	NPN, Signal	04713	3-23904
Q26	F2701	FET, N, CH	Solitron	3-22701
Q27	F2701	FET, N, CH	Solitron	3-22701
Q28	2N3904	NPN, Signal	04713	3-23904
Q29	2N3904	NPN, Signal	04713	3-23904
Q30	2N3906	PNP, Signal	04713	3-23906
Q31	2N3904	NPN, Signal	04713	3-23904
Q32	2N3906	PNP, Signal	04713	3-23906
Q33	2N3904	NPN, Signal	04713	3-23904
Q34	2N3906	PNP, Signal	04713	3-23906
Q35	2N3904	NPN, Signal	04713	3-23904
Q36	2N3906	PNP, Signal	04713	3-23906
Q37	2N3906	PNP, Signal	04713	3-23906
Q38	2N3904	NPN, Signal	04713	3-23904
Q39	2N3906	PNP, Signal	04713	3-23906
Q40	2N3904	NPN, Signal	04713	3-23904
Q41	2N3904	NPN, Signal	04713	3-23904
Q42	2N3904	NPN, Signal	04713	3-23904
Q43	2N3904	NPN, Signal	04713	3-23904
Q44	F2701	FET, N, CH	Solitron	3-22701
		MISCELLANEOUS		
	570-1510-01-0519	Standoff	Cambion	4-20199
	9752007	Shield, Input	34160	1-20089
4 Req.	CDH4000-16	Socket, I.C., 16 Pin	SAE	2-60009
2 Req.	516-AG7D	Socket, Right Angle, 16 Pin	Augat	2-60008
4 Req.	SO-440-8	Standoff, 4-40 Captive, 1/4"L	46384	4-20288
P5	03-06-2061	Connector, Plug	Molex	2-24024
P6,1-6	02-06-2103	Terminal Pin, Male	Molex	2-24022
9 Req.	9152030	Button	34160	1-10716
	MS51957-12	Screw, Panhead, 4-40 X 3/16'	-	8-10012
	MS35333-70	Washer, #4 Int, Lk	-	8-40002

Table 6-23. Parts List (DMM-Counter Chassis Assy 9755011)

REFERENCE DESIGNATOR	MANUFACTURER PART NUMBER	DESCRIPTION	MANU-FACTURER	VU-DATA PART NO.
	*PS915/975 only #PS935/975 only	-1 Assy -3 Assy		
	9755001	DMM-Counter Sub-Assy	34160	
	9752015	Front Panel,975B	34160	1-10825
	9752014	Sub-Front Panel	34160	1-10796
	9752016	Sub Panel	34160	1-10826
2 Req. *	9752005	Mounting Plate	34160	1-10725
#	9752005	Mounting Plate	34160	1-10725
J302	256-Green	Banana Jack-Green	83330	4-20309
J301	256-Red	Banana Jack-Red	83330	4-20313
	A2197	Eyelet, Rolled Flange	Stimpson	
	MS24693-2	Screw, 100° Flathead, 4-40 X 1/4		
3 Req.	MS51957-13	Screw, Panhead, 4-40 X 1/4	-	8-20013
3 Req.	MS3533-70	Washer, Int Lk, #4	-	8-10013
4 Req. *	AD42ABS	Pop Rivet	-	4-20294
2 Req. #	AD42ABS	Pop Rivet	-	4-20294
2 Req.	NAS671C2	Nut, 2-56	-	8-30003
2 Req.	MS35333-69	Washer, #2 Int. Lk.	-	8-40001
2 Req.	MS35333-74	Washer, 1/4 Int. Lk.	-	8-40006
	2713-31294-N253	Washer, Shoulder	Amatom	8-60004

SECTION VII

DRAWINGS

LIST OF DRAWINGS

Figure 7-1. Vertical Input Schematic 9501001
Figure 7-2. Vertical Signal Schematic 9501002
Figure 7-3. Vertical Interconnect Schematic 9501003
Figure 7-4. Vertical Output Schematic 9501004
Figure 7-5. High Voltage & CRT Control Schematic 9351025
Figure 7-6. Horizontal Schematic 9351027
Figure 7-6. Horizontal Schematic 9351027(Continued)
Figure 7-6. Horizontal Schematic 9351027(Continued)
Figure 7-7. Power Supply Schematic 9351007
Figure 7-8. Power Supply Batt Pack Schematic 9351019
Figure 7-9. DMM-Counter Schematic 9751001
Figure 7-9. DMM-Counter Schematic 9751001(Continued)
Figure 7-10. Interconnect Wiring Diagram 9351014
Figure 7-11. Interconnect Wiring Diagram-Telefunken 9351024

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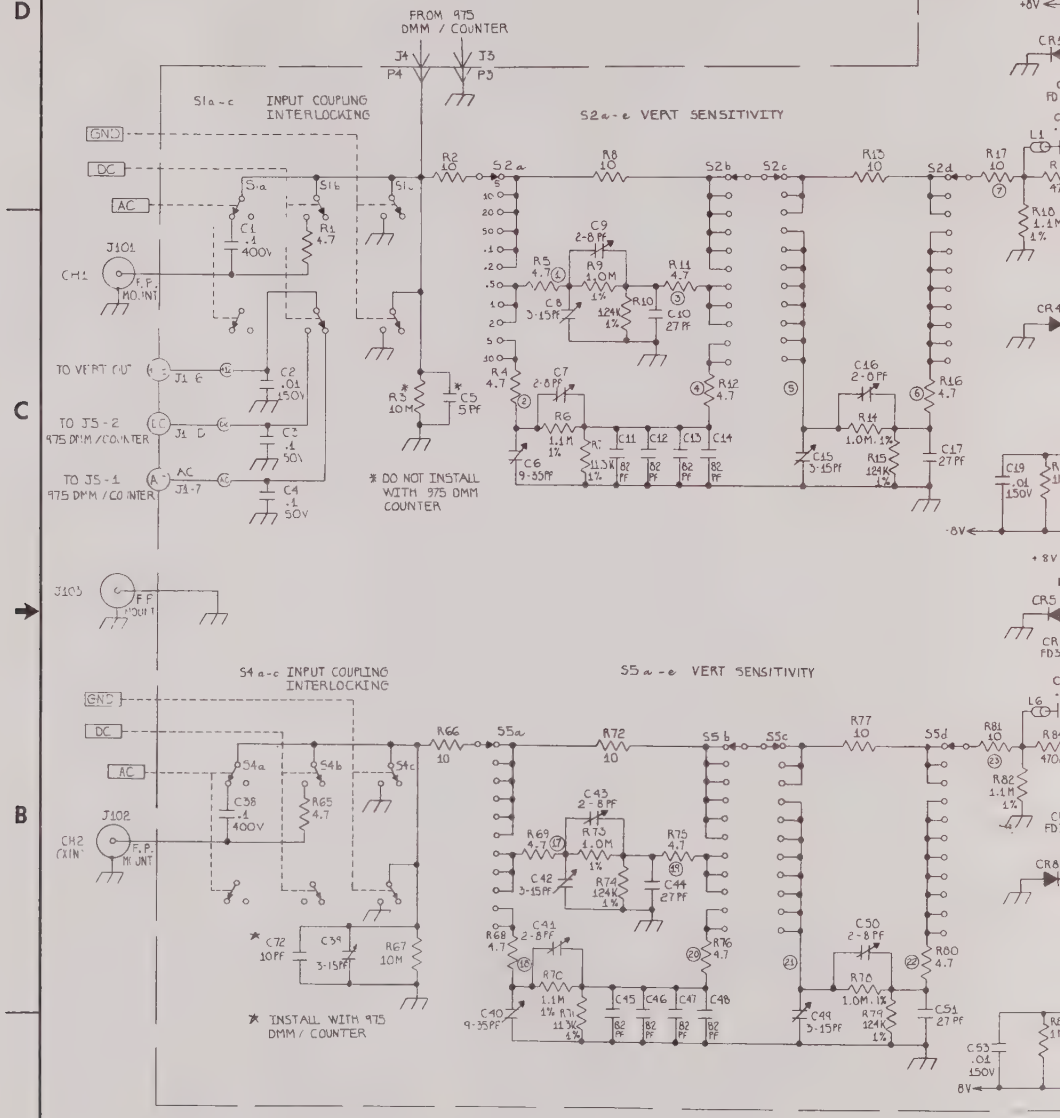


NOTES: UNLESS OTHERWISE SPECIFIED

1. CAPACITORS ARE IN MICROFARADS, 500V
2. RESISTORS ARE IN OHMS, 1/4 W, 5%. 1% ARE 1/8 W
3. DIODES ARE 1N914
4. -N INDICATES NOMINAL VALUE

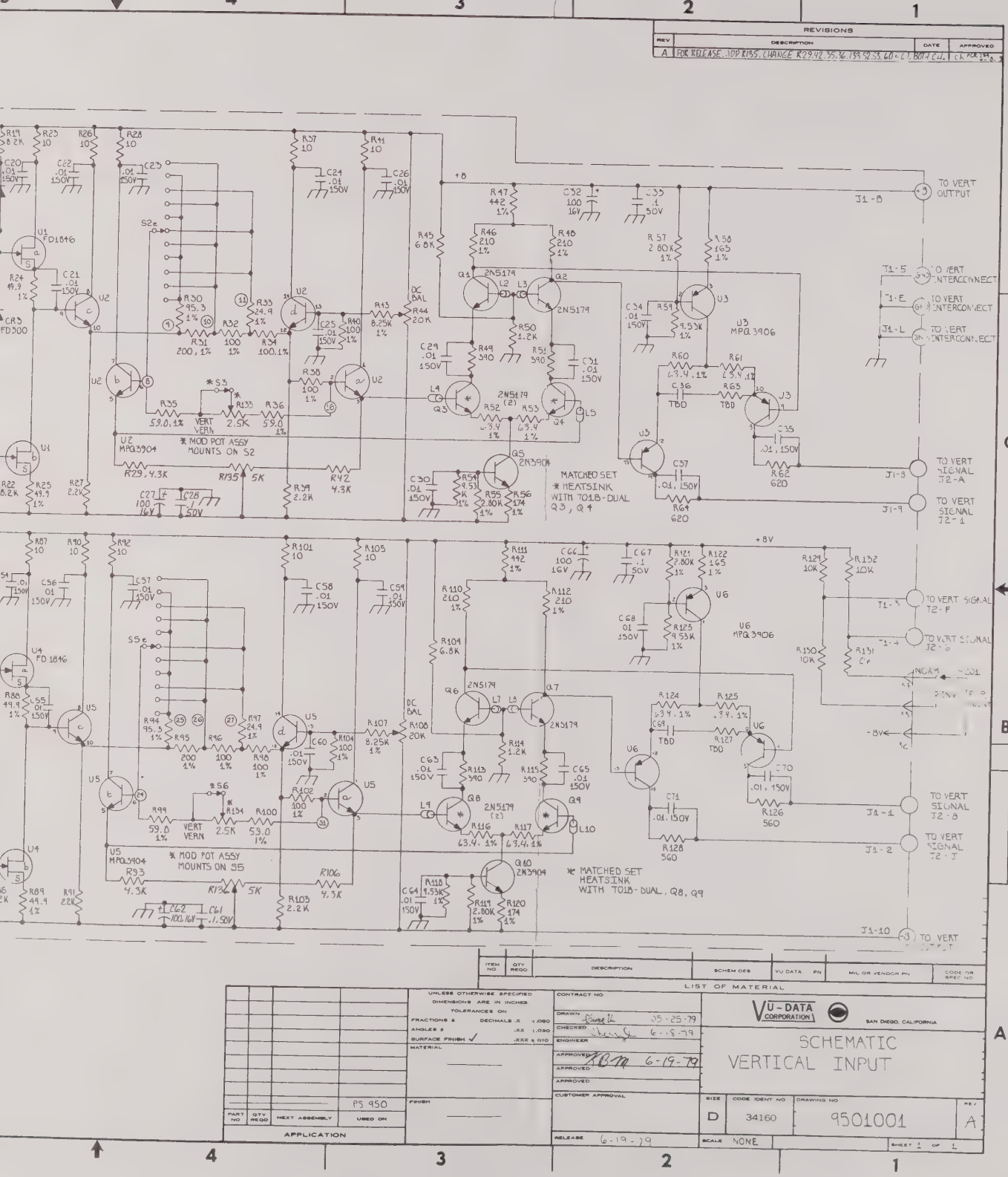
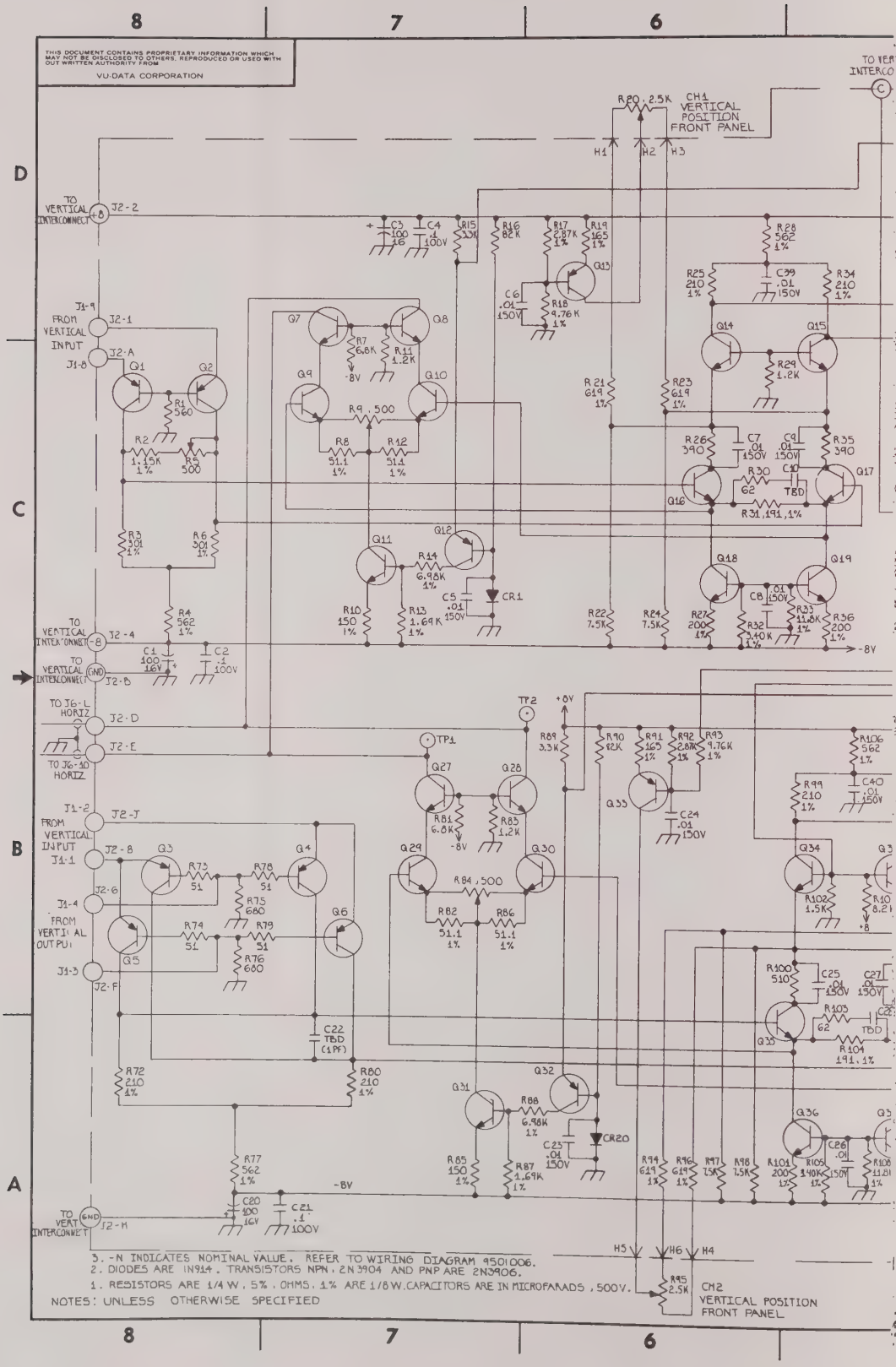


Figure 7-1. Vertical Input Schematic 9501001


THIS DOCUMENT CONTAINS PROPRIETARY INFORMATION WHICH MAY NOT BE DISCLOSED TO OTHERS, REPRODUCED OR USED WITH OUT WRITTEN AUTHORITY FROM
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8
7
6
D
C
B
A
CH1 VERTICAL POSITION FRONT PANEL
CH2 VERTICAL POSITION FRONT PANEL
TO VERTICAL INTERCONNECT J2-2
FROM VERTICAL INPUT J1-1
FROM VERTICAL OUTPUT J1-3
TO VERT INTERCONNECT J2-M
TO J6-L HORIZ J2-D
TO J6-10 HORIZ J2-E
-8V
+8V
TP1
TP2
NOTES: UNLESS OTHERWISE SPECIFIED
1. RESISTORS ARE 1/4 W, 5%, OHMS, 1% ARE 1/8 W. CAPACITORS ARE IN MICROFARADS, 500V.
2. DIODES ARE 1N914. TRANSISTORS NPN, 2N3904 AND PNP ARE 2N3906.
3. -N INDICATES NOMINAL VALUE. REFER TO WIRING DIAGRAM 9501006.

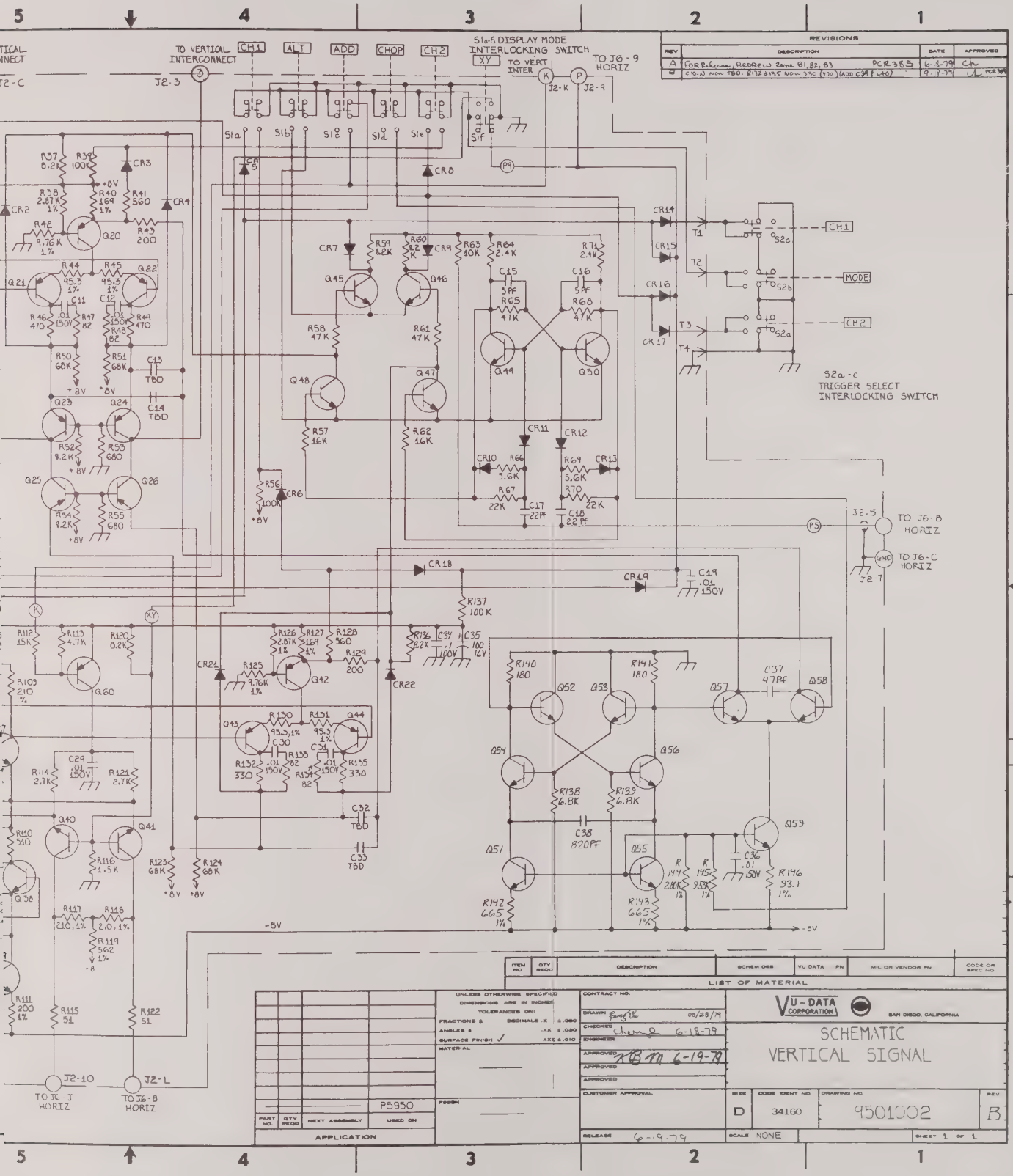

Figure 7-2. Vertical Signal Schematic 9501002

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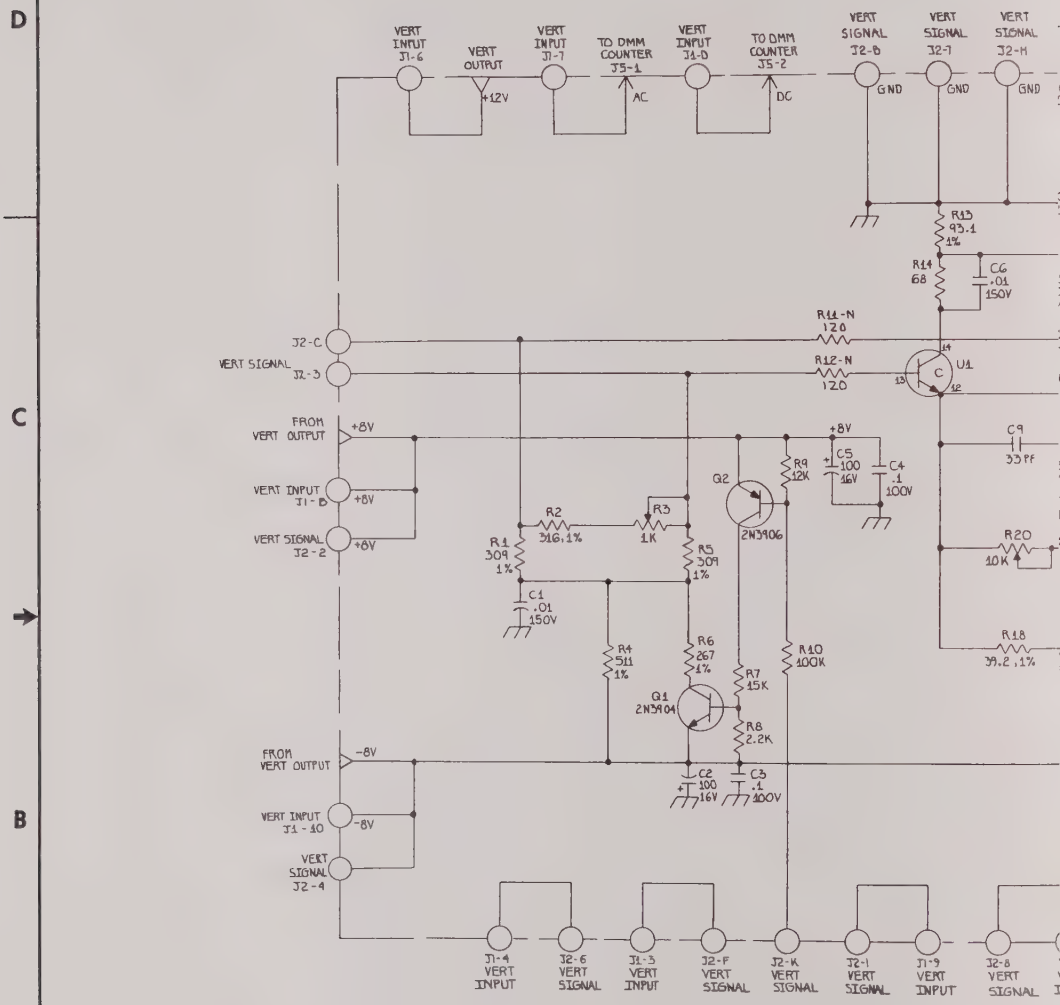


NOTES : UNLESS OTHERWISE SPECIFIED.
1. RESISTORS ARE 1/4 W, OHMS, 5%. 1% ARE 1/8W.
2. CAPACITORS ARE IN MICROFARADS, 500V.
3. -N INDICATES NOMINAL VALUE

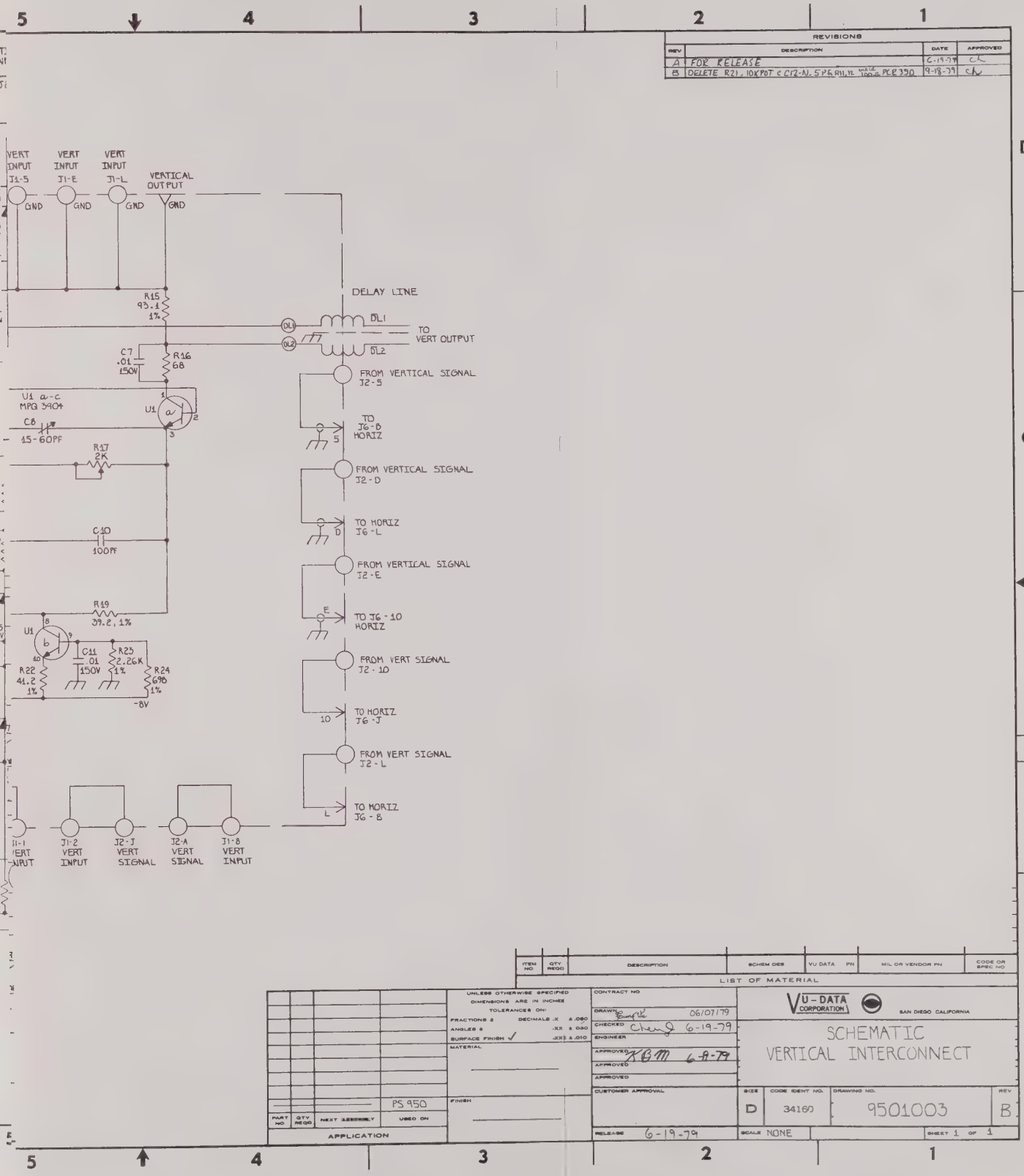
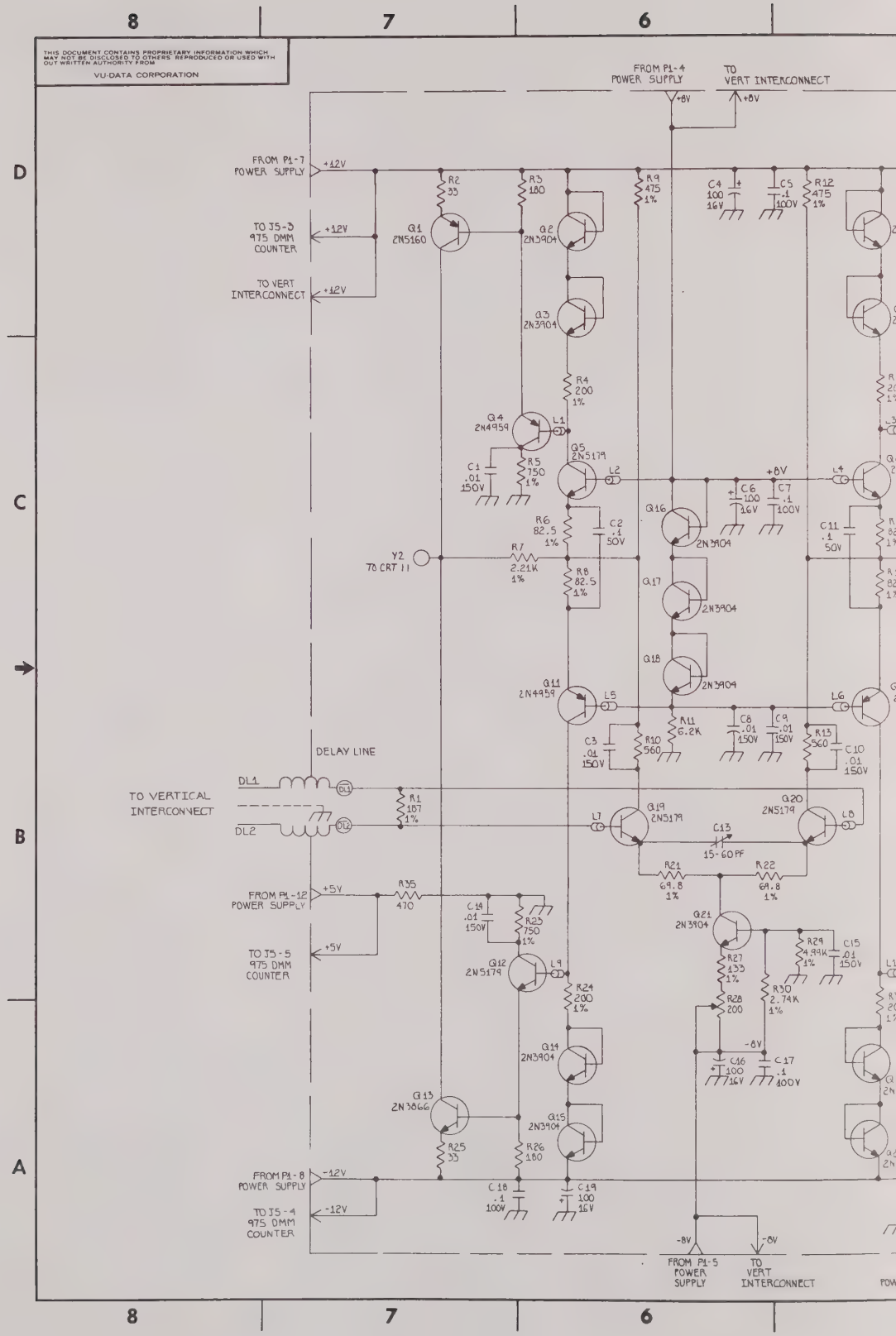


Figure 7-3. Vertical Interconnect Schematic 9501003


8
7
6
D
C
B
A
THIS DOCUMENT CONTAINS PROPRIETARY INFORMATION WHICH MAY NOT BE DISCLOSED TO OTHERS, REPRODUCED OR USED WITH OUT WRITTEN AUTHORITY FROM
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FROM P1-4 POWER SUPPLY
+8V
TO VERT INTERCONNECT
+8V
FROM P1-7 POWER SUPPLY
+12V
TO J5-3 975 DMM COUNTER
+12V
TO VERT INTERCONNECT
+12V
R2 33
R3 180
R9 475 1%
C4 100 16V
C5 .1 100V
R12 475 1%
Q1 2N5160
Q2 2N3904
Q3 2N3904
R4 200 1%
Q4 2N4959
L1
C1 .01 150V
Q5 2N5179
L2
R5 750 1%
+8V
C6 100 16V
C7 .1 100V
L4
Q16 2N3904
C11 .1 50V
R6 82.5 1%
C2 .1 50V
Y2 TO CRT 11
R7 2.21K 1%
R8 82.5 1%
Q17 2N3904
Q18 2N3904
Q11 2N4959
L5
L6
C3 .01 150V
R10 560
R11 6.2K
C8 .01 150V
C9 .01 150V
R13 560
C10 .01 150V
DELAY LINE
DL1
DL2
TO VERTICAL INTERCONNECT
R1 187 1%
Q19 2N5179
Q20 2N5179
L7
L8
C13 15-60 PF
R21 69.8 1%
R22 69.8 1%
FROM P1-12 POWER SUPPLY
+5V
R35 470
C14 .01 150V
R23 750 1%
Q21 2N3904
TO J5-5 975 DMM COUNTER
+5V
Q12 2N5179
L9
R29 4.99K 1%
C15 .01 150V
R27 133 1%
R28 200
R30 2.74K 1%
R24 200 1%
-8V
Q14 2N3904
C16 100 16V
C17 .1 100V
Q13 2N3866
Q15 2N3904
R25 33
R26 180
FROM P1-8 POWER SUPPLY
-12V
TO J5-4 975 DMM COUNTER
-12V
C18 .1 100V
C19 100 16V
-8V
FROM P1-5 POWER SUPPLY
-8V
TO VERT INTERCONNECT

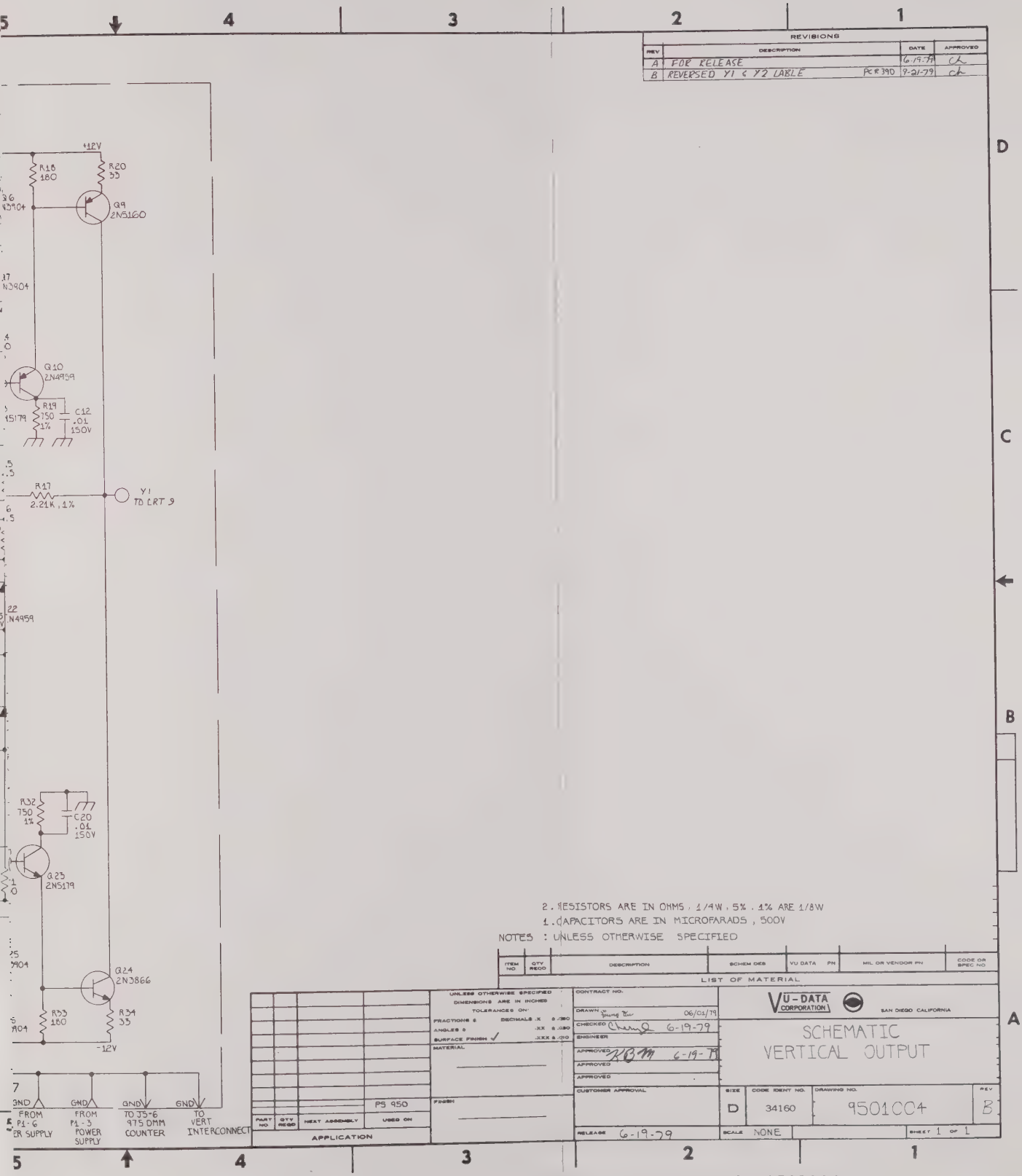
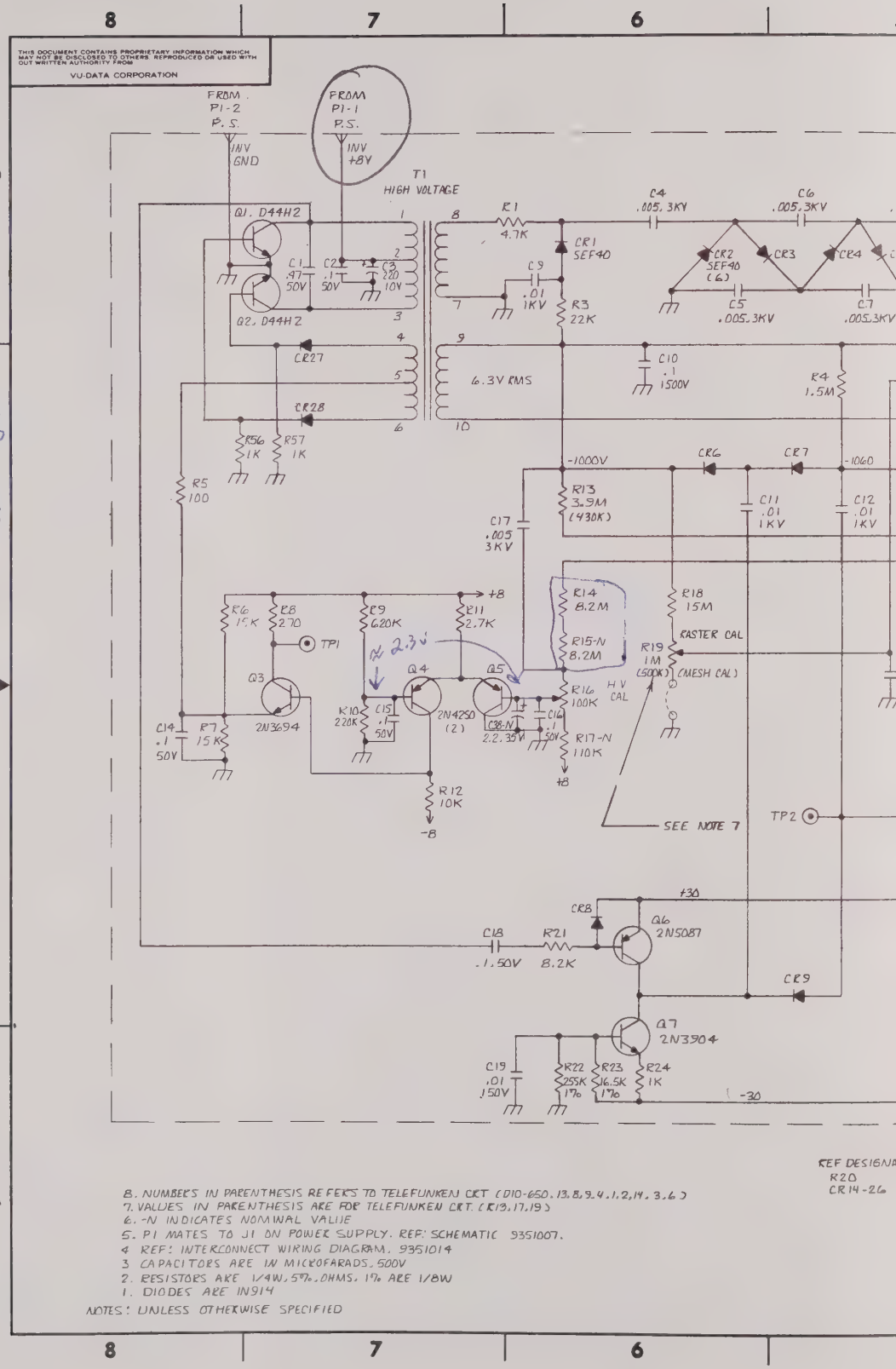

REVISIONS
REV DESCRIPTION DATE APPROVED
A FOR RELEASE 6-19-79 CL
B REVERSED Y1 & Y2 LABLE PCR 390 9-21-79 CL
+12V
R18 180
R20 33
Q9 2N5160
Q10 2N4959
R19 750 1% C12 .01 150V
R17 2.21K, 1%
Y1 TO CRT 9
R32 750 1% C20 .01 150V
Q23 2N5179
Q24 2N3866
R33 180
R34 33
-12V
GND FROM P1-6 ER SUPPLY
GND FROM P1-3 POWER SUPPLY
GND TO J5-6 975 DMM COUNTER
GND TO VERT INTERCONNECT
NOTES : UNLESS OTHERWISE SPECIFIED
1. CAPACITORS ARE IN MICROFARADS, 500V
2. RESISTORS ARE IN OHMS, 1/4W, 5%. 1% ARE 1/8W
LIST OF MATERIAL
ITEM NO QTY REQD DESCRIPTION SCHEM DES VU DATA PN MIL OR VENDOR PN CODE OR SPEC NO
VU-DATA CORPORATION SAN DIEGO CALIFORNIA
SCHEMATIC VERTICAL OUTPUT
SIZE D CODE IDENT NO. 34160 DRAWING NO. 9501004 REV B
SCALE NONE SHEET 1 OF 1
PS 950
APPLICATION

Figure 7-4. Vertical Output Schematic 9501004

P.N 7-8 T1
286Ω
20KHz

Set HV for
1000 at Min intensity
Should vary ± 10V
adjust with R47



REF DESIGNA
R20
CR14-26

8. NUMBERS IN PARENTHESIS REFERS TO TELEFUNKEN CRT (D10-650, 13, 8, 9, 4, 1, 2, 14, 3, 6)
7. VALUES IN PARENTHESIS ARE FOR TELEFUNKEN CRT. (R13, 17, 19)
6. -N INDICATES NOMINAL VALUE
5. P1 MATES TO J1 ON POWER SUPPLY. REF: SCHEMATIC 9351007.
4. REF: INTERCONNECT WIRING DIAGRAM, 9351014
3. CAPACITORS ARE IN MICROFARADS, 500V
2. RESISTORS ARE 1/4W, 5%. OHMS, 1% ARE 1/8W
1. DIODES ARE IN914

NOTES: UNLESS OTHERWISE SPECIFIED

BRIGHT Dot + won't shut off Focus w

Q6+7 CR6,7,8,9

Focus Doesn't

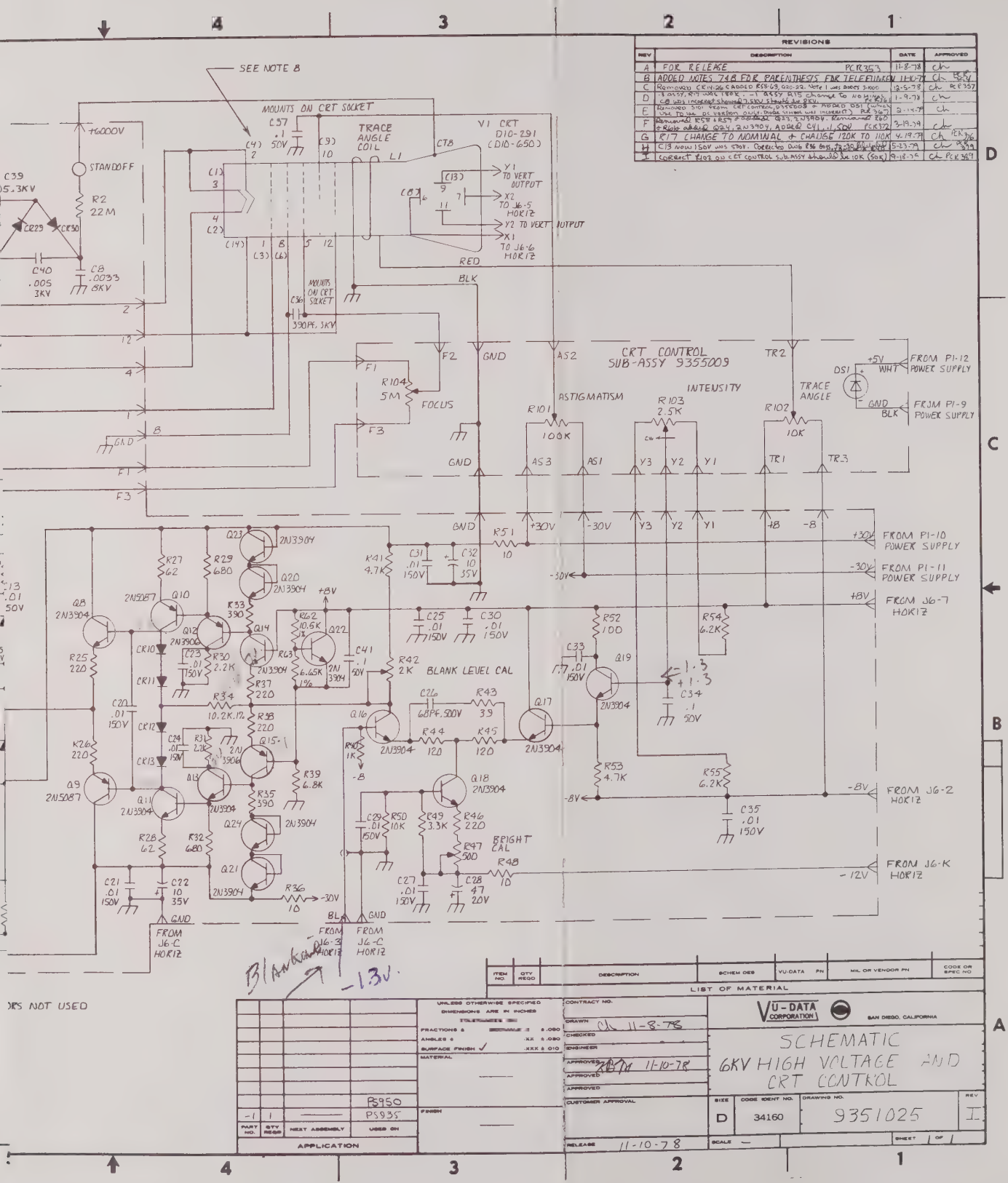


Figure 7-5. High Voltage & CRT Control Schematic 9351025

Original

UNDER R19-15N OPEN

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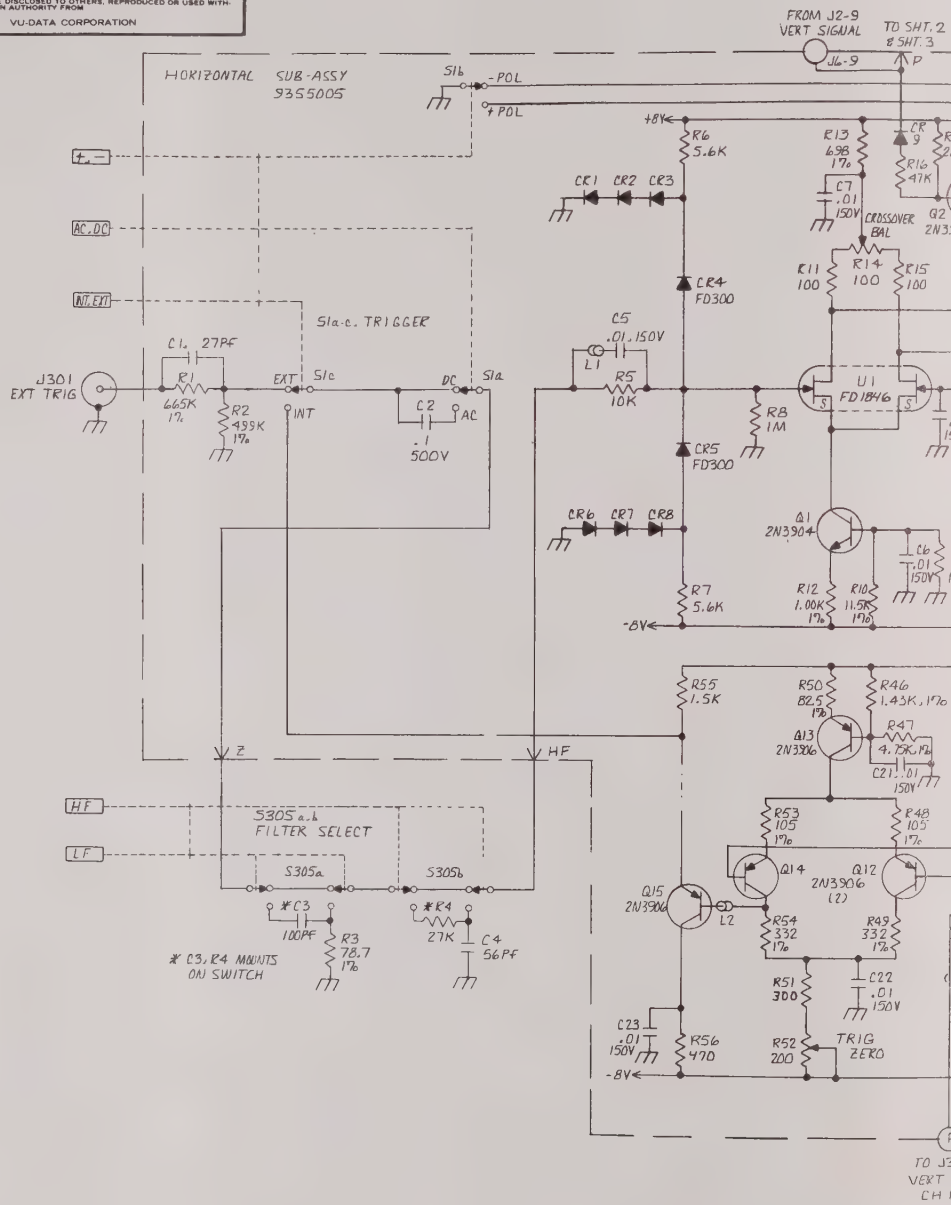

8. 300 SERIES IS FRONT PANEL MOUNT
7. -N INDICATES NOMINAL VALUE
6. HORIZ. SWEEP GEN SHOWN ON SHT. 2 & HORIZ OUTPUT SHOWN ON SHT. 3
5. CONSTANT CURRENT, 9353006, SHOWN ON SHT 2
4. BOARD PLUGS INTO J6. REF. 9351014 WIRING DIAGRAM
3. DIODES ARE IN914
2. CAPACITORS ARE IN MICROFARADS, 50OV
1. RESISTORS ARE IN OHMS, 1/4W, 5%, 1% ARE VOW

NOTES: UNLESS OTHERWISE SPECIFIED

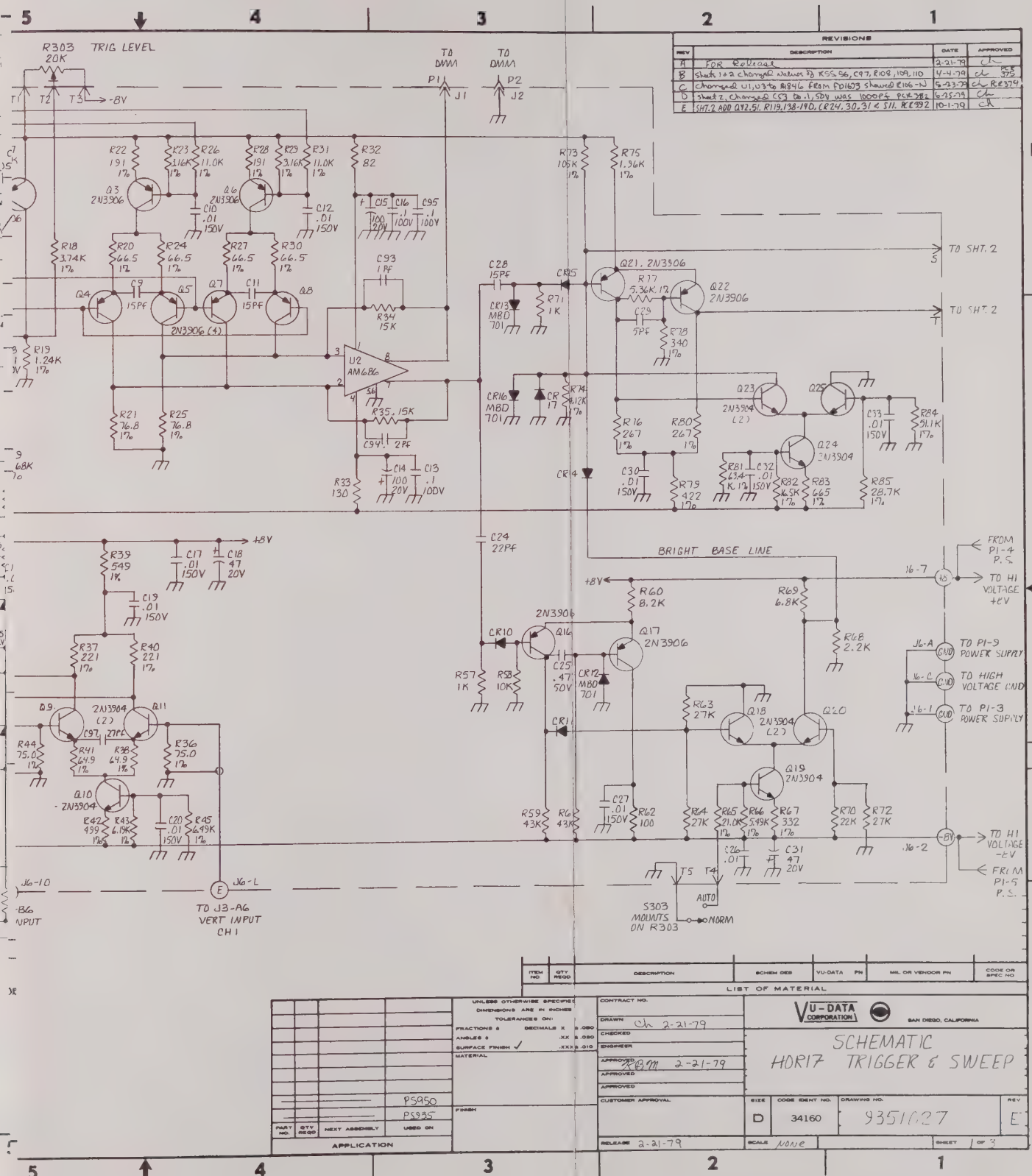

Figure 7-6. Horizontal Schematic 9351027

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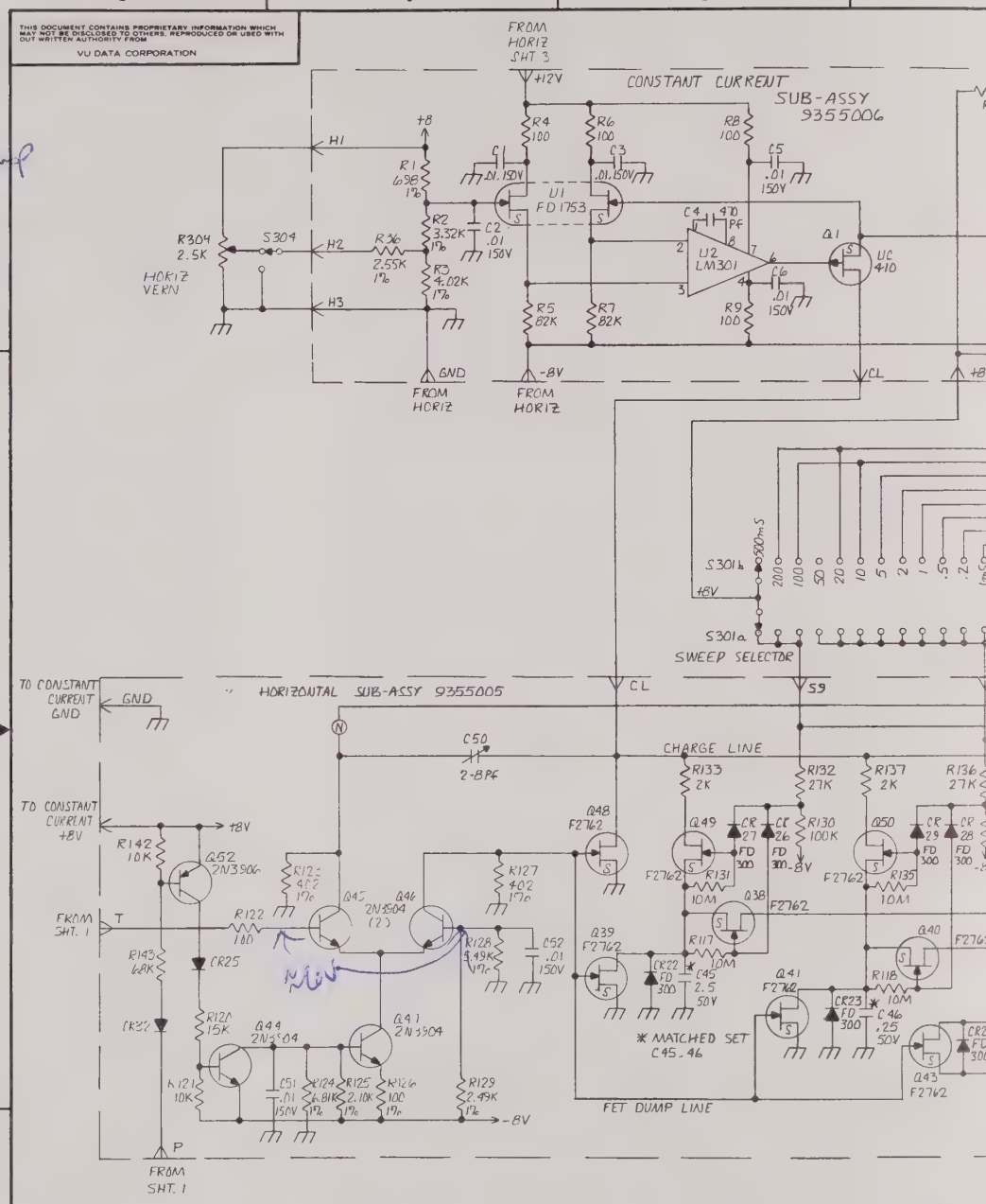
TP 1 For Sweep Gate



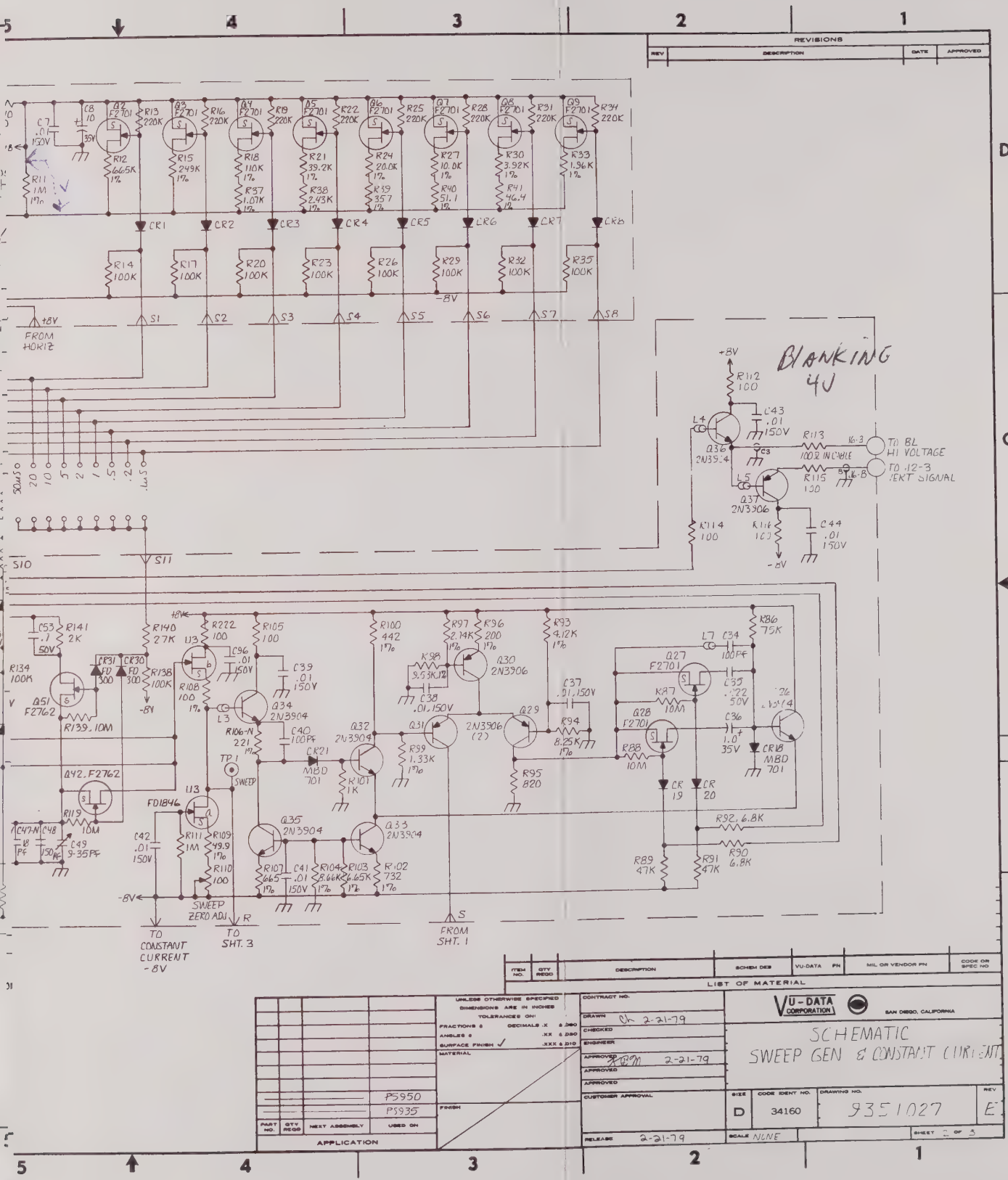


Figure 7-6. Horizontal Schematic 9351027 (Continued)

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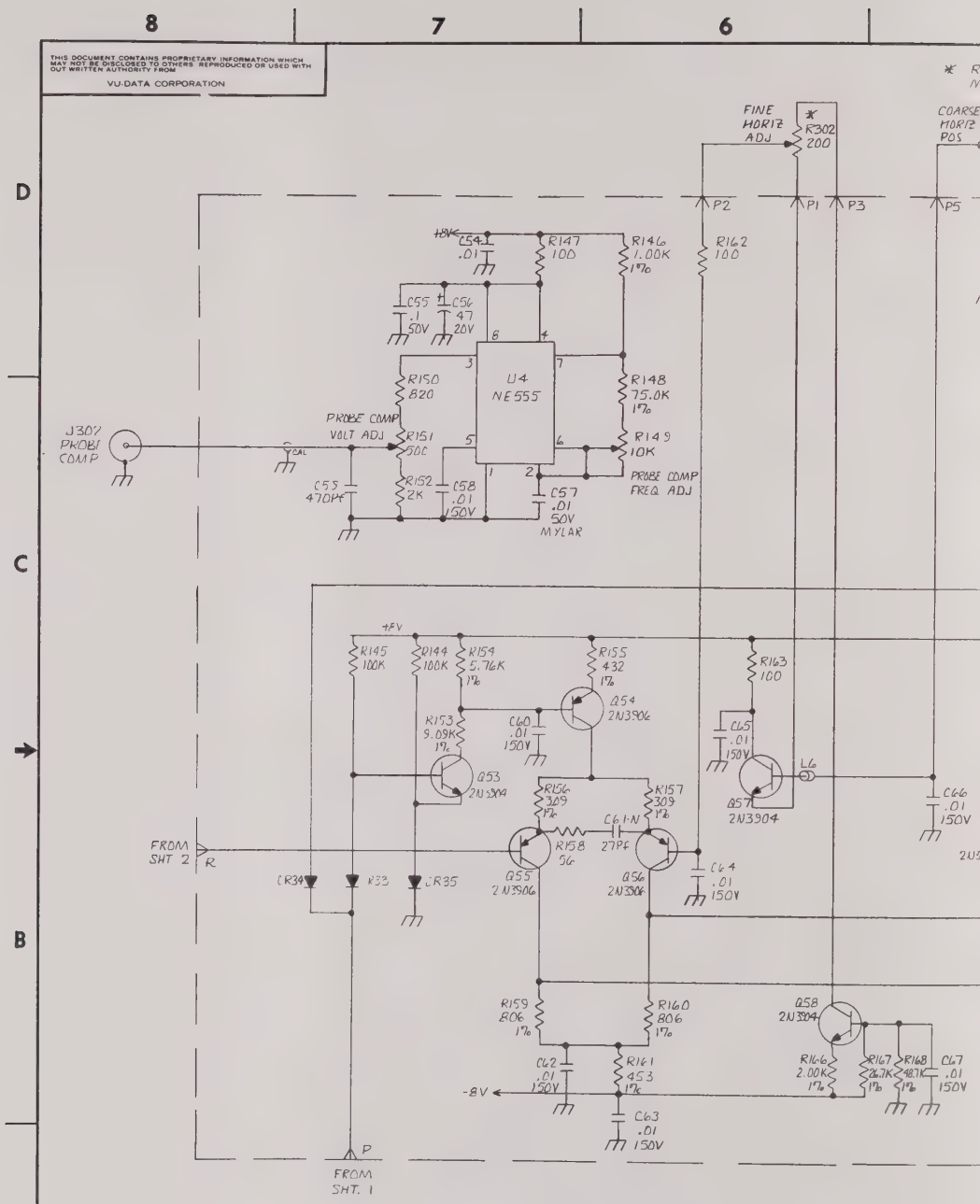

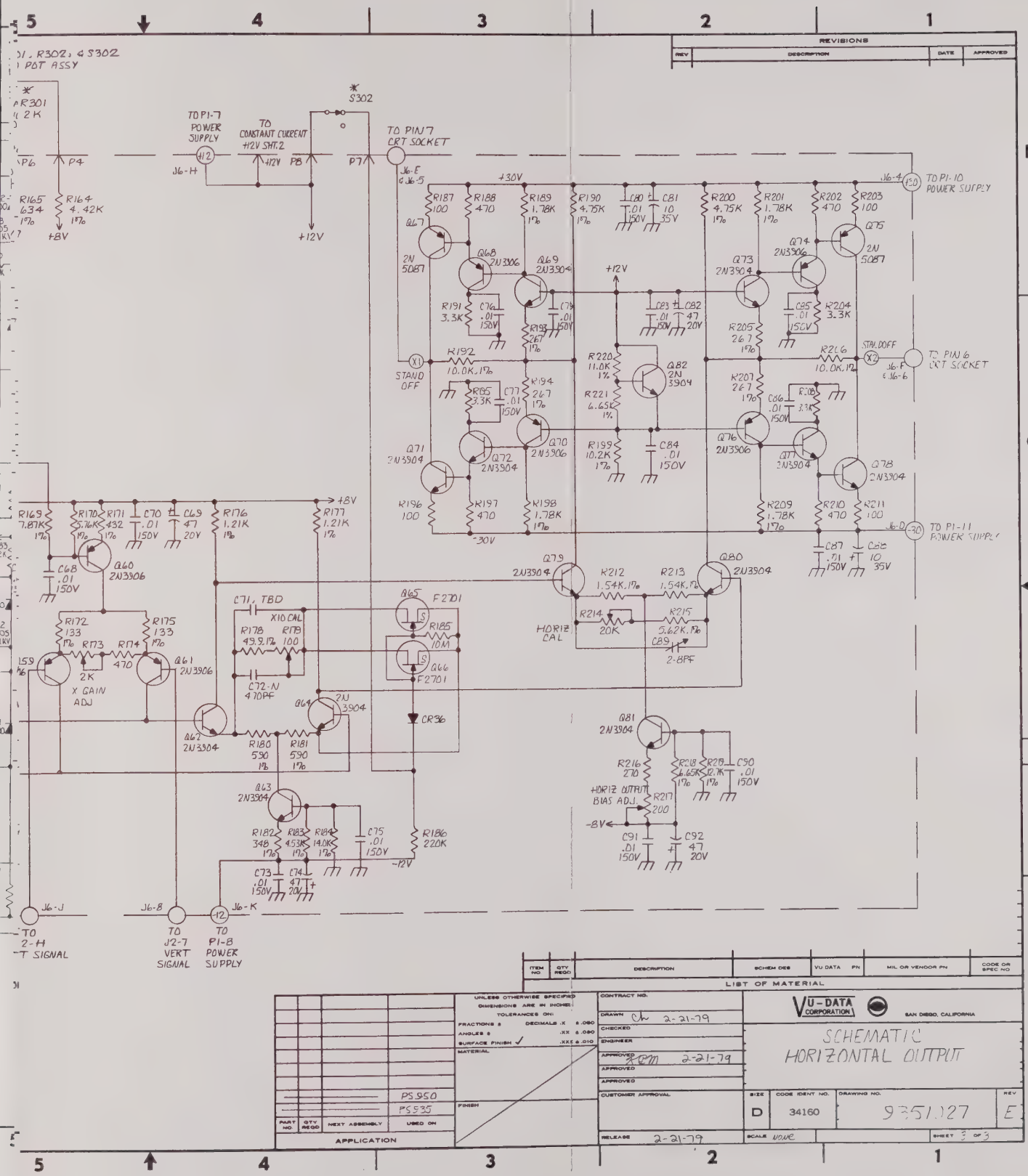

Figure 7-6. Horizontal Schematic 9351027 (Continued)

THIS DOCUMENT CONTAINS PROPRIETARY INFORMATION WHICH MAY NOT BE DISCLOSED TO OTHERS, REPRODUCED OR USED WITH OUT WRITTEN AUTHORITY FROM
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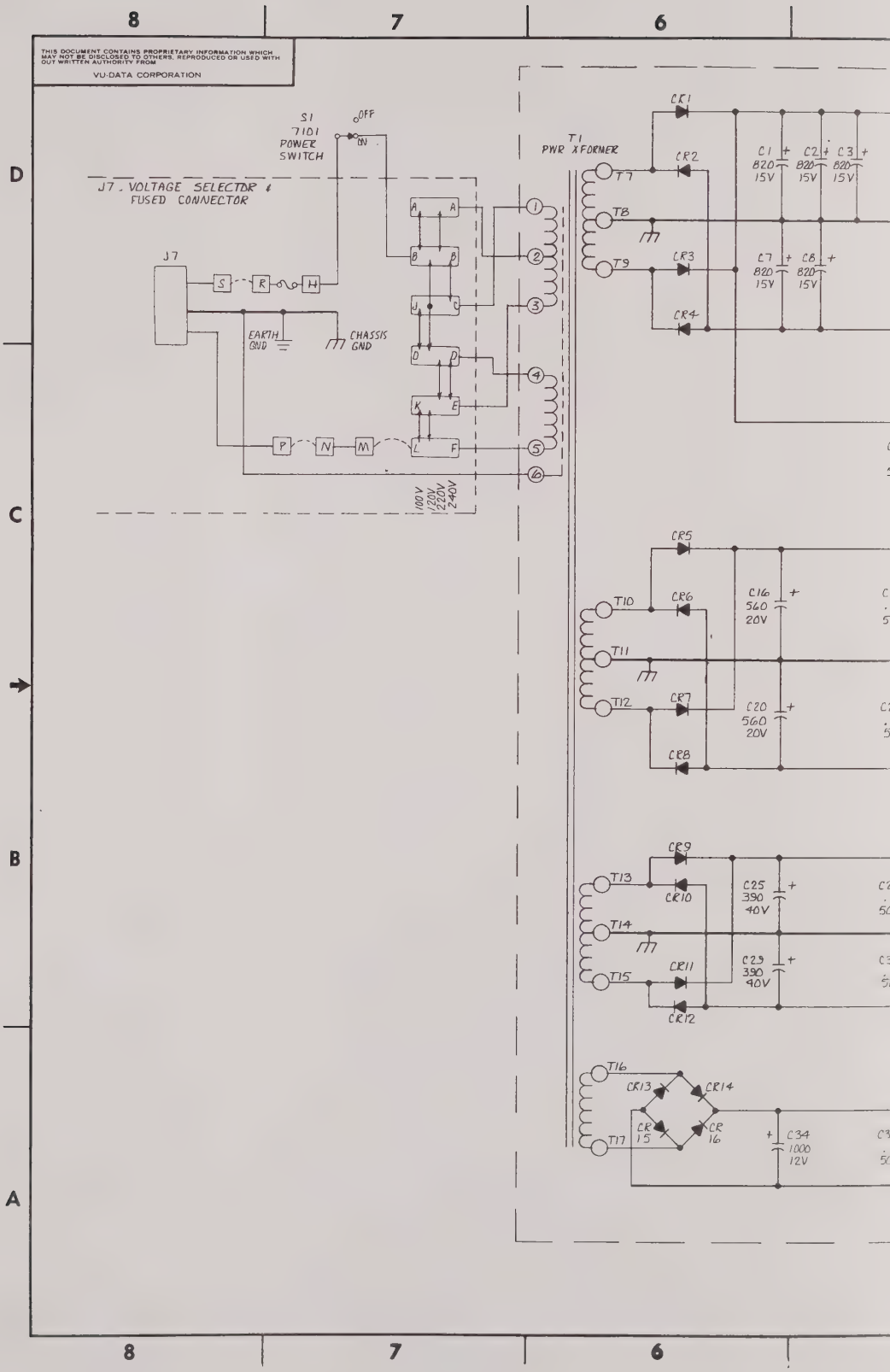

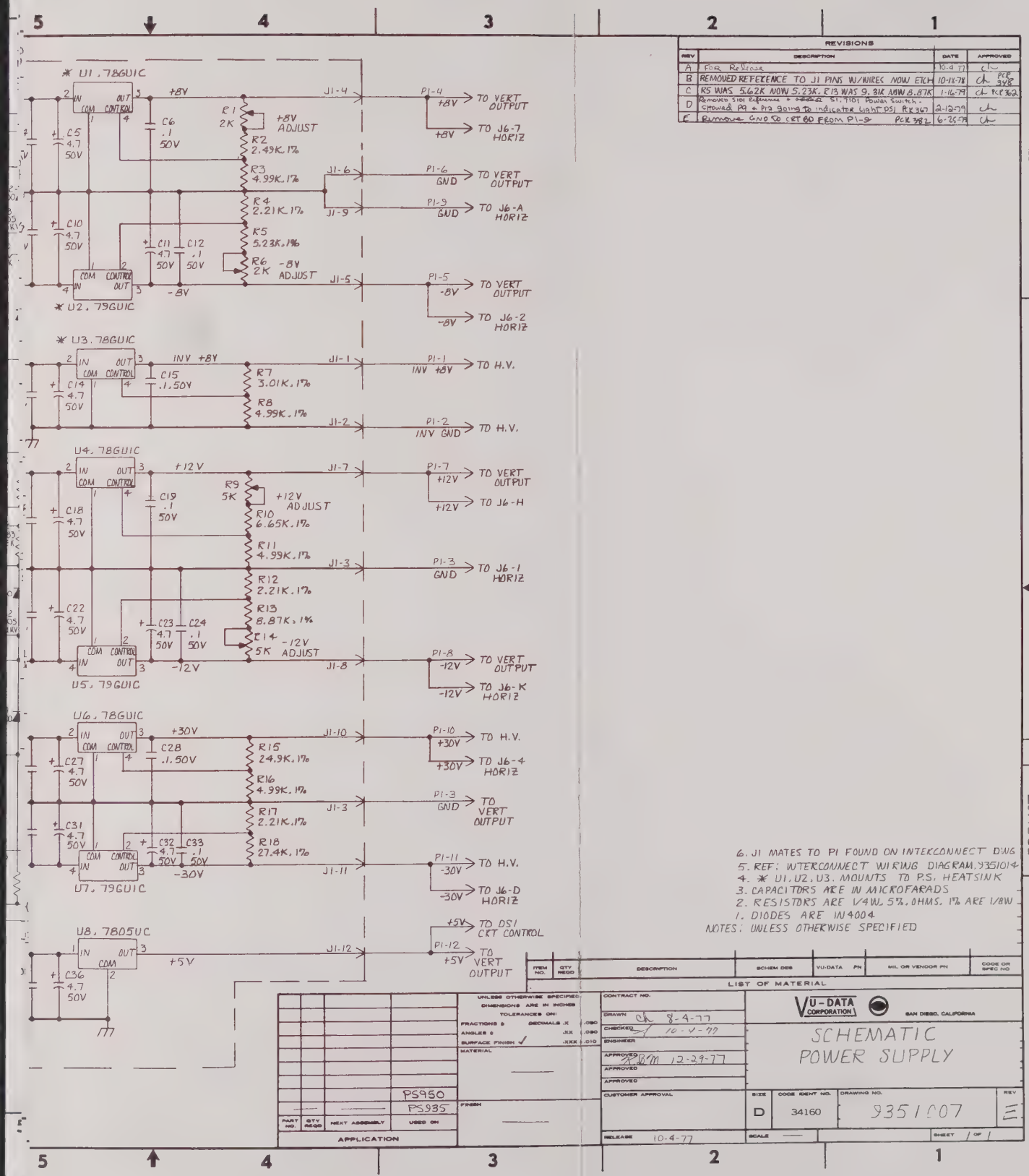

Figure 7-7. Power Supply Schematic 9351007

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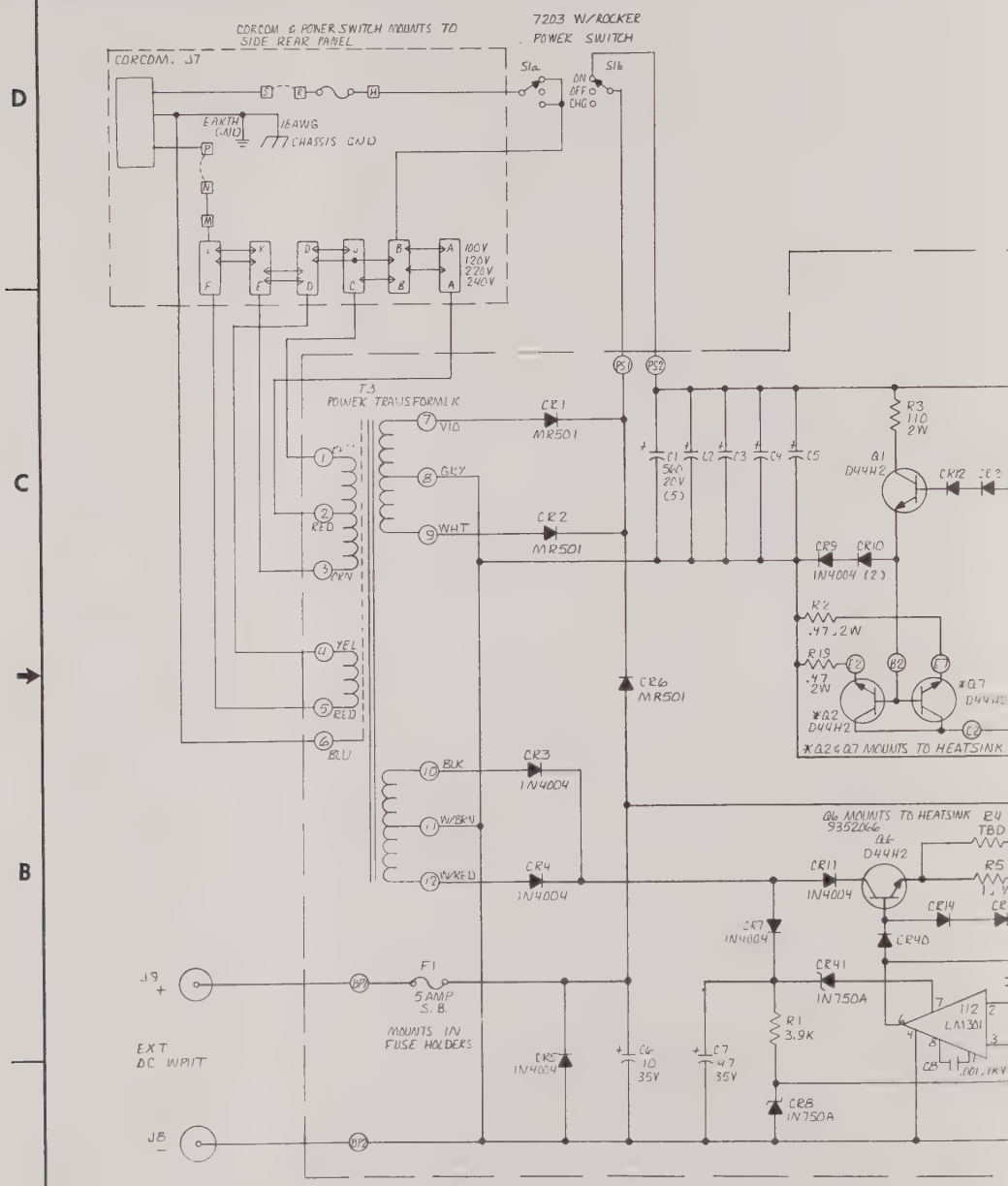

5. J1 MATES TO P1 FOUND ON WIRING DIAGRAM
4 REF: INTERCONNECT WIRING DIAGRAM 9351014
3. CAPACITORS ARE IN MICROFARADS
2. RESISTORS ARE 1/4W, 5%, OHMS. 1% ARE 1/2W.
1. DIODES ARE IN914

NOTES: UNLESS OTHERWISE SPECIFIED

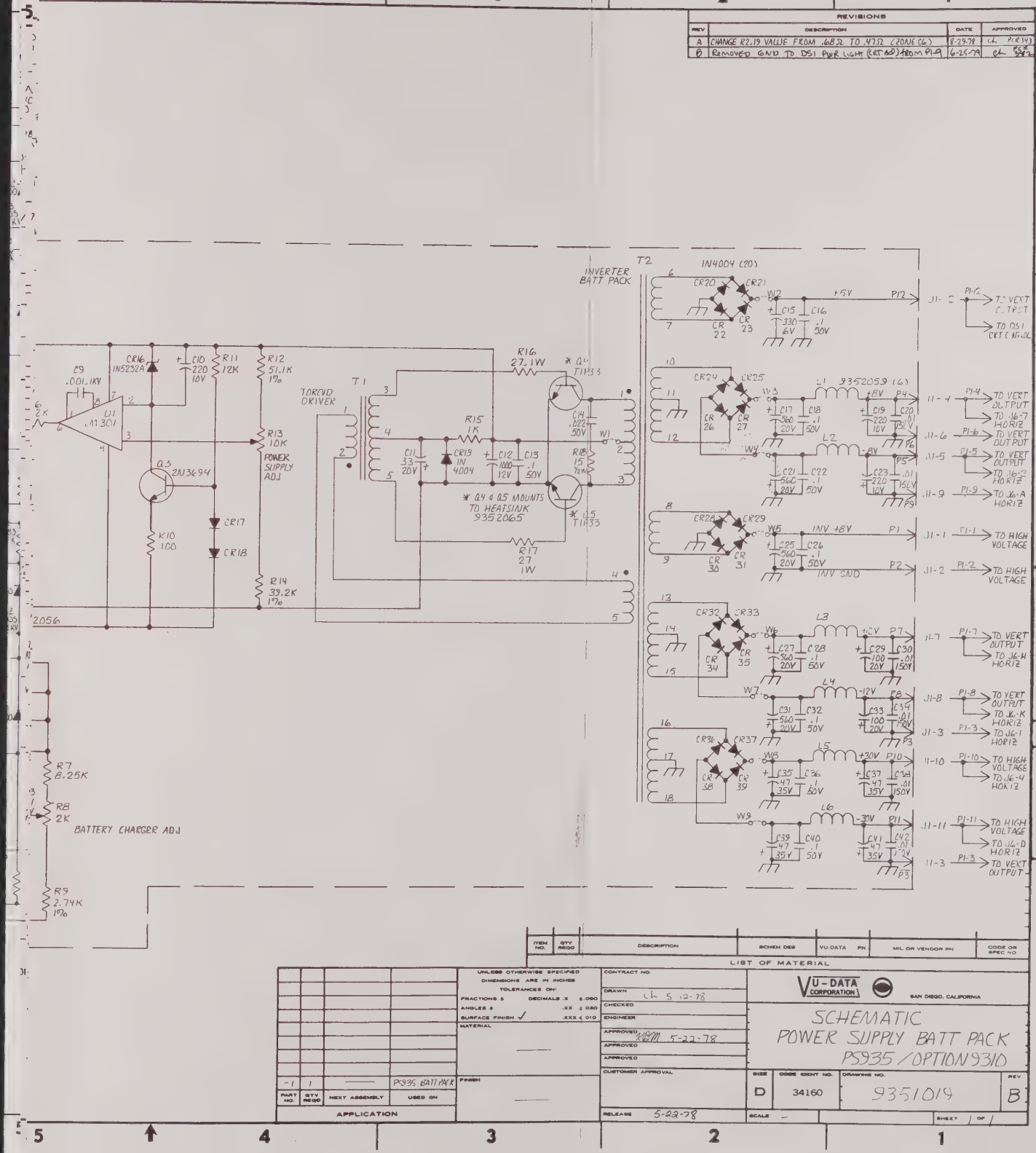

Figure 7-8. Power Supply Batt Pack Schematic 9351019

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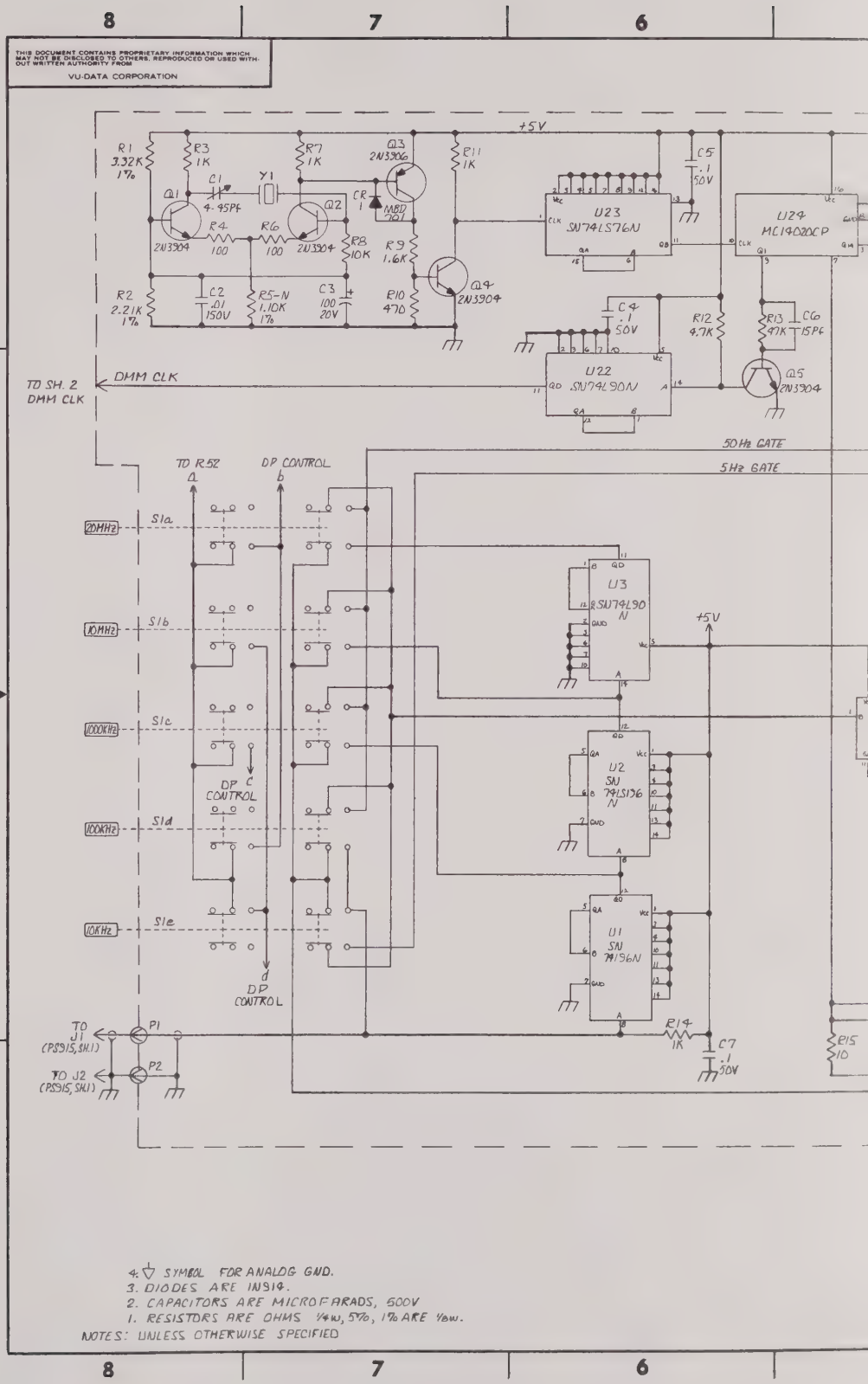


4. ⏚ SYMBOL FOR ANALOG GND.
3. DIODES ARE IN914.
2. CAPACITORS ARE MICROFARADS, 600V
1. RESISTORS ARE OHMS ¼W, 5%, 1% ARE ½W.

NOTES: UNLESS OTHERWISE SPECIFIED

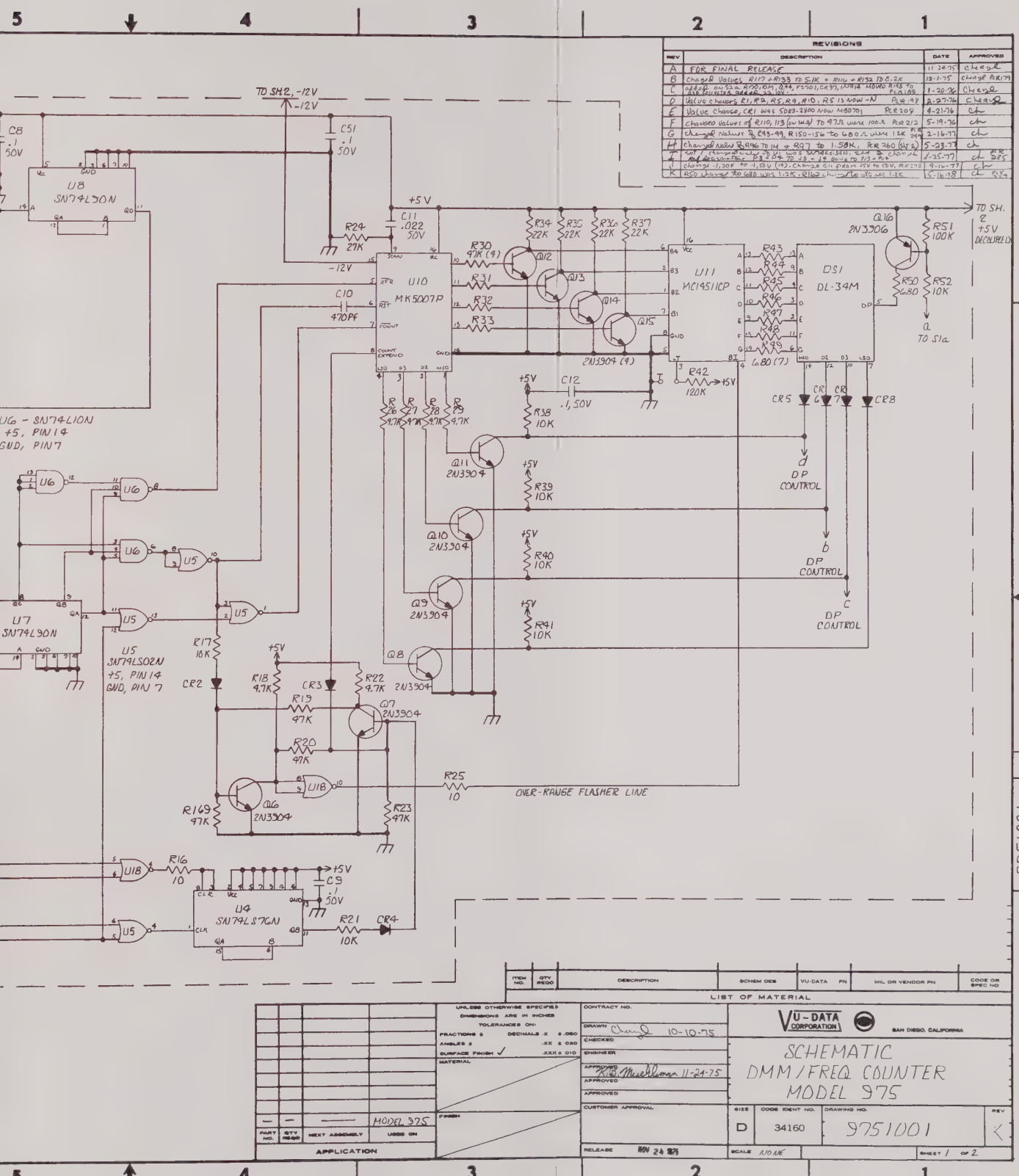
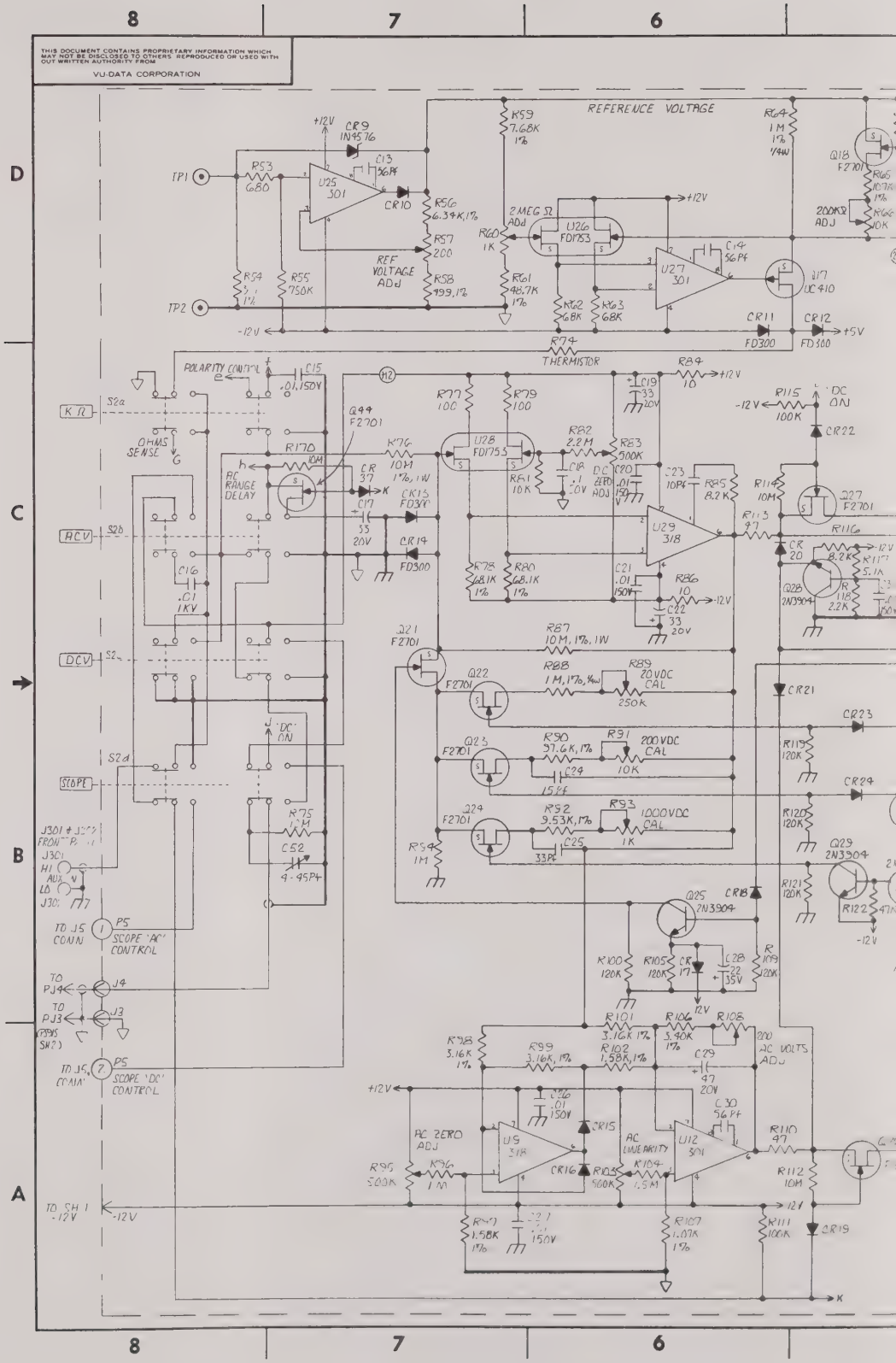

REVISIONS
REV DESCRIPTION DATE APPROVED
A FOR FINAL RELEASE 11-24-75 CHANGE
B Change Values R117 + R133 TO 5.1K + R116 + R132 TO 2.2K 12-1-75 CHANGE PER 179
C add CR5 thru CR8, R43-49, R150-156 to 680Ω, MOVE R148 to R38, relocate DP21, 22, 18, 20 PER 189 1-20-76 CHANGE
D Value changes R1, R2, R5, R9, R10, R15 NOW -N PER 197 2-27-76 CHANGE
E Value Change, CR1 was 5082-2800 NOW MA0701 PER 209 4-21-76 ch
F Changed Values of R110, 113 (ea ea) TO 932Ω were 100Ω PER 212 5-19-76 ch
G Changed Values of R43-49, R150-156 to 680Ω were 1K PER 249 2-16-77 ch
H Changed Value of R96 TO 1M + R97 TO 1.58K. PER 260 (ea) 5-23-77 ch
J "SN7" changed to "U" on U5 SCHEMATIC. CHG ☒ CHG'D PER 285 1-25-77 ch
K change 1.20K TO 1.21K (1%) change CR1 from MA to MV, PER 332 9-14-77 ch
L ALSO change to 680 was 1.21K, R160 thru R166 was 1.21K 5-16-78 ch PER 354
TO SH2, -12V
-12V
+5V
TO SH. 2 +5V DECOUPLED
C8 .1 50V
C51 .1 50V
C11 .022 50V
C10 470PF
C12 .1, 50V
U8 SN74L30N
U10 MK5007P
U11 MC14511CP
DS1 DL-34M
R24 27K
R30 47K (9)
R31
R32
R33
R34 22K
R35 22K
R36 22K
R37 22K
R38 10K
R39 10K
R40 10K
R41 10K
R42 120K +5V
R43 680
R44 680
R45 680
R46 680
R47 680
R48 680
R49 680
R50 680
R51 100K
R52 10K
R26 9.7K
R27 9.7K
R28 9.7K
R29 9.7K
Q11 2N3904
Q10 2N3904
Q9 2N3904
Q8 2N3904
Q7 2N3904
Q6 2N3904
Q12
Q13
Q14
Q15
2N3904 (9)
Q16 2N3906
CR1 CR2 CR3 CR4 CR5 CR6 CR7 CR8
U6 - SN74L10N +5, PIN 14 GND, PIN 7
U7 SN74L90N
U5 SN74LS02N +5, PIN 14 GND, PIN 7
U4 SN74LS74AN
U18
R16 10
R17 10K
R18 9.7K
R19 47K
R20 47K
R21 10K
R22 9.7K
R23 47K
R25 10
R169 47K
C9 .1 50V
OVER-RANGE FLASHER LINE
a TO S1a
a DP CONTROL
b DP CONTROL
c DP CONTROL
9751001
LIST OF MATERIAL
ITEM NO. QTY REQD DESCRIPTION SCHEM DES VU-DATA PN MIL OR VENDOR PN CODE OR SPEC NO
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON: FRACTIONS ± DECIMALS .X ± .050 ANGLES ± .XX ± .030 SURFACE FINISH ✓ .XXX ± .010 MATERIAL FINISH
CONTRACT NO.
DRAWN Chang 10-10-75
CHECKED
ENGINEER
APPROVED R.B. Muehlman 11-24-75
APPROVED
APPROVED
CUSTOMER APPROVAL
RELEASE NOV 24 1975
APPLICATION PART NO. QTY REQD NEXT ASSEMBLY MODEL 975 USED ON
VU-DATA CORPORATION SAN DIEGO, CALIFORNIA
SCHEMATIC DMM/FREQ COUNTER MODEL 975
SIZE D CODE IDENT NO. 34160 DRAWING NO. 9751001 REV K
SCALE NONE SHEET 1 OF 2

Figure 7-9. DMM-Counter Schematic 9751001


8
7
6
D
C
B
A
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VU-DATA CORPORATION
REFERENCE VOLTAGE
+12V
-12V
+5V
TP1
TP2
CR9 IN4576
C13 56PF
U25 301
CR10
R53 680
R54 5.1 1%
R55 750K
R56 6.34K,1%
R57 200
REF VOLTAGE ADJ
R58 499,1%
R59 7.68K 1%
2 MEG Ω ADJ
R60 1K
R61 48.7K 1%
U26 FD1753
R62 6.8K
R63 6.8K
U27 301
C14 56PF
CR11 FD300
CR12 FD300
R64 1M 1% 1/4W
Q18 F2701
R65 10.7K 1%
200KΩ ADJ
R66 10K
U17 UC410
R74 THERMISTOR
POLARITY CONTROL
C15 .01,150V
S2a
K Ω
OHMS SENSE
R170 10M
AC RANGE DELAY
Q99 F2701
CR 37
CR13 FD300
C17 .33 20V
CR14 FD300
S2b
ACV
C16 .01 1KV
S2c
DCV
S2d
STOPE
J301 & J302 FRONT PANEL
J301 HI
AUX
LO
J302
R75 1M
C52 4-45PF
TO J5 CONN
P5 SCOPE 'AC' CONTROL
TO PJ4
J4
TO PJ3
J3
(PASS SW2)
TO J5 CONN
P5 SCOPE 'DC' CONTROL
TO SH 1 -12V
R77 100
R79 100
U28 FD1753
R81 10K
R82 2.2M
R83 300K
C18 .1 20V
R84 10
C19 33 20V
R85 8.2K
C20 .01 150V
DC ZERO ADJ
C23 10PF
R86 10
C22 33 20V
R87 10M, 1%, 1W
R88 1M, 1%, ¼W
R89 20VDC CAL 250K
R90 37.6K, 1%
R91 200VDC CAL 10K
C24 15PF
R92 9.53K, 1%
R93 1000VDC CAL 1K
C25 33PF
R94 1M
R78 68.1K 1%
R80 68.1K 1%
C21 .01 150V
U29 318
R115 100K
CR22
R114 10M
Q27 F2701
R113 97
R116
CR 20
8.2K
R117 5.1K
Q28 2N3904
R 118 2.2K
CR21
CR23
R119 120K
CR24
R120 120K
Q29 2N3904
R121 120K
R122 47K
Q25 2N3904
CR18
R100 120K
R105 120K
CR 17
C28 22 35V
R 109 20K
R101 3.16K 1%
R106 3.40K 1%
R108 200 AC VOLTS ADJ
R98 3.16K 1%
R99 3.16K, 1%
R102 1.58K, 1%
C29 47 20V
C26 .01 150V
C30 56 PF
AC ZERO ADJ
U9 318
U12 301
AC LINEARITY
CR15
CR16
R96 500K
R96 1M
R103 500K
R104 1.5M
R110 47
R112 10M
R97 1.58K 1%
C27 .22 150V
R107 1.07K 1%
R111 100K
CR19
K

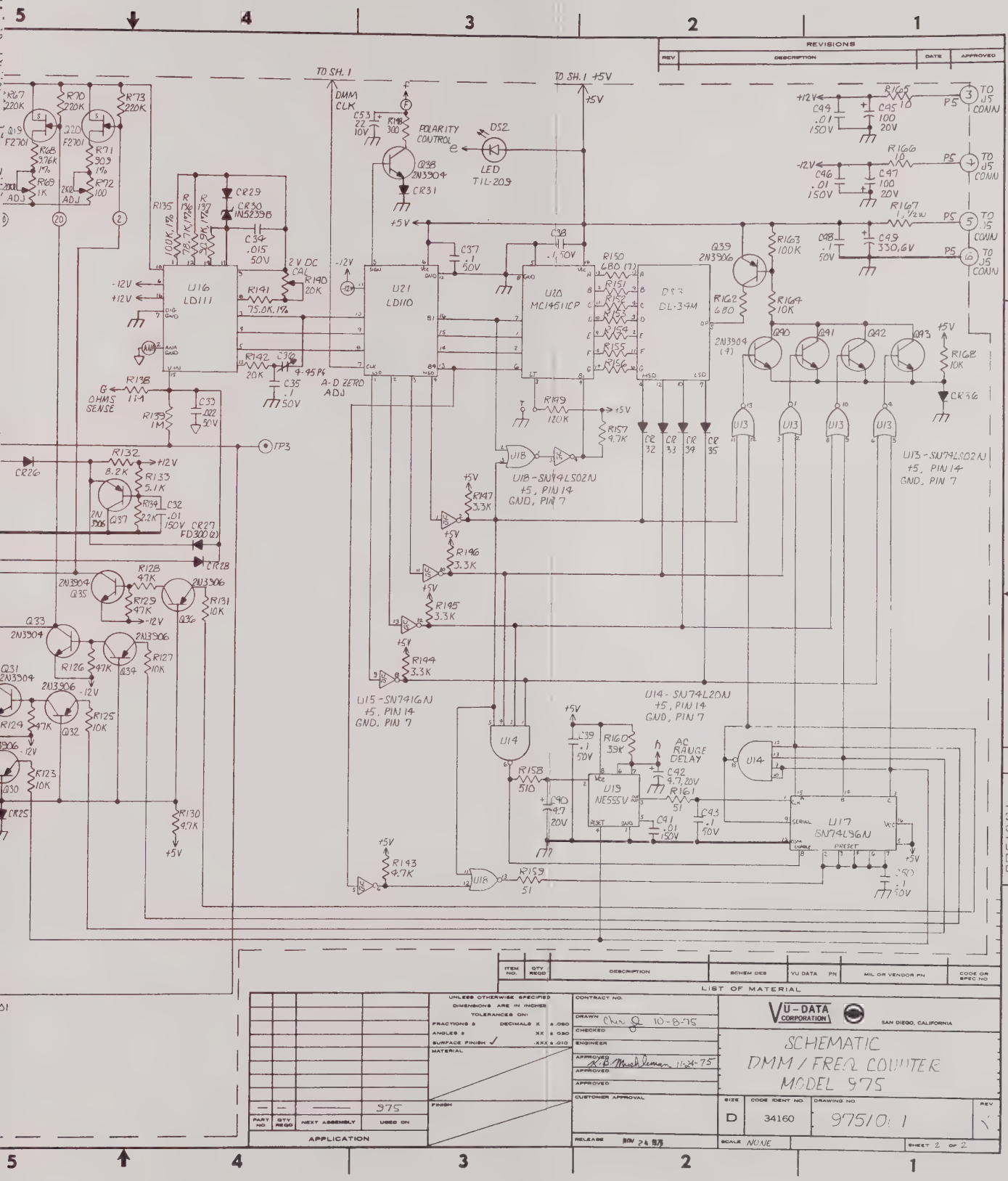

Figure 7-9. DMM-Counter Schematic 9751001(Continued)

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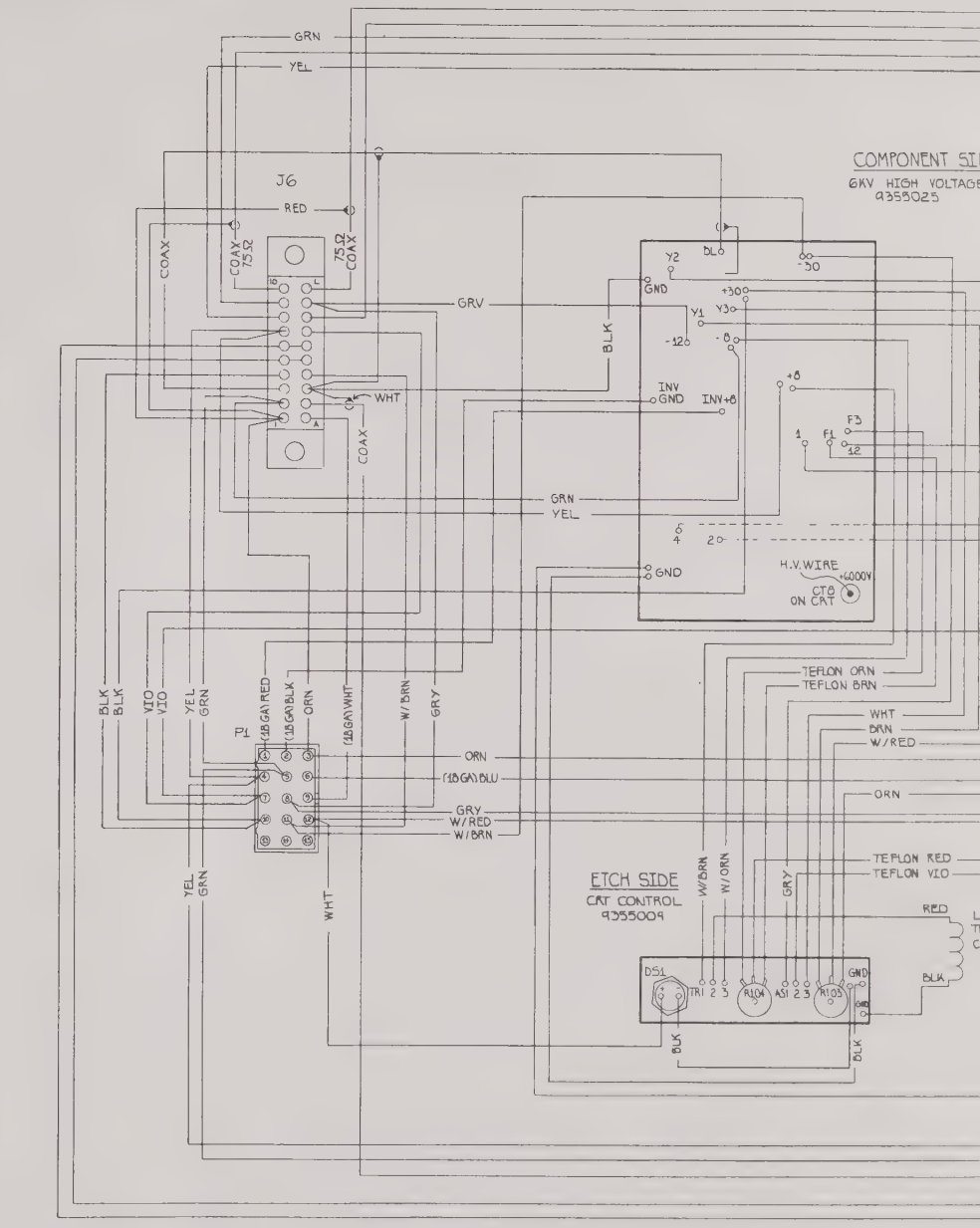

NOTES : UNLESS OTHERWISE SPECIFIED
1. TEFLON WIRES MUST BE INSTALLED (8 PLACES)
2. 18GA WIRES MUST BE INSTALLED (5 PLACES)
3. DOTTED LINES INDICATE WIRES TO GO ON OPPOSITE SIDE OF bds SHOWN

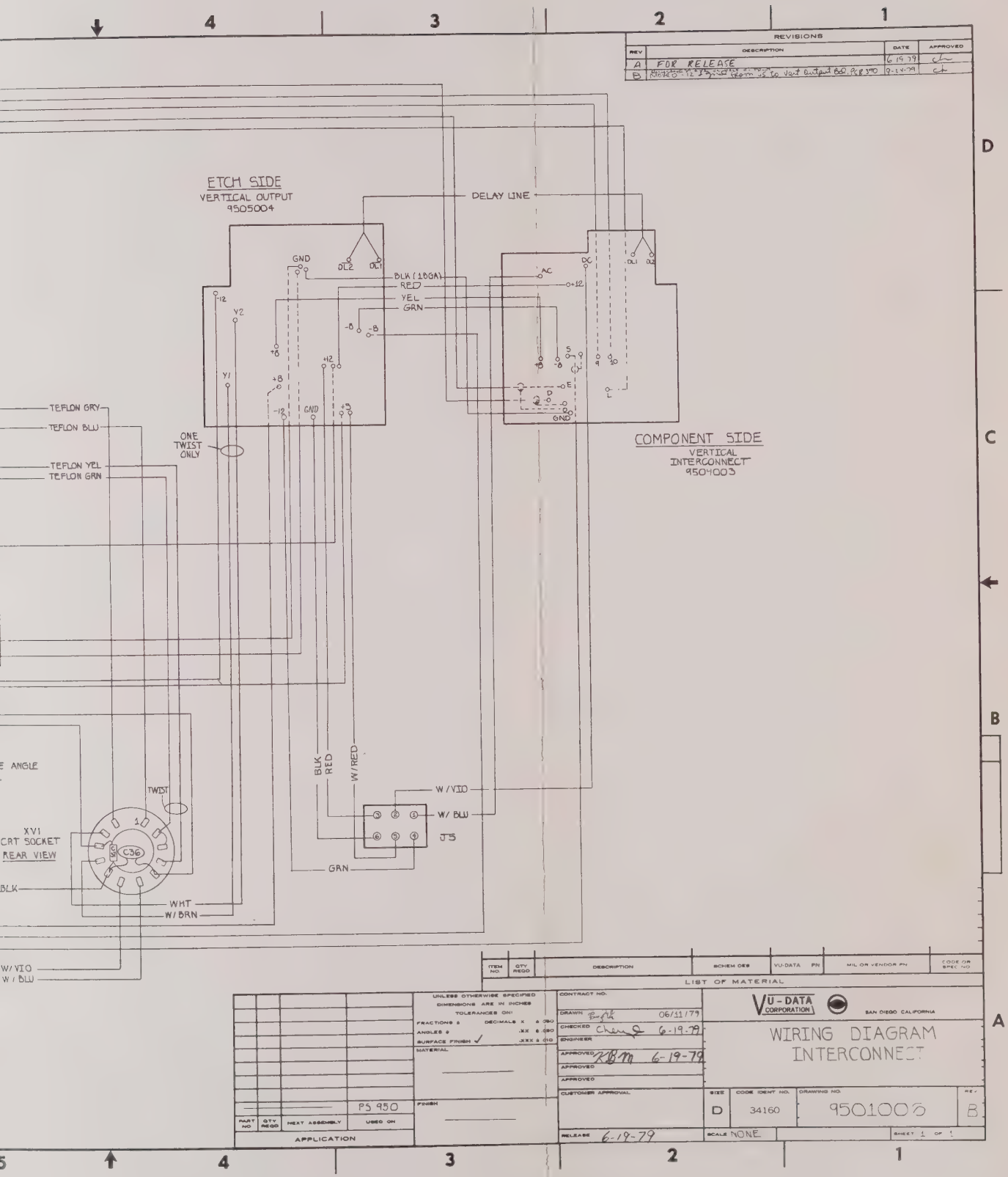

Figure 7-10. Interconnect Wiring Diagram 9501006

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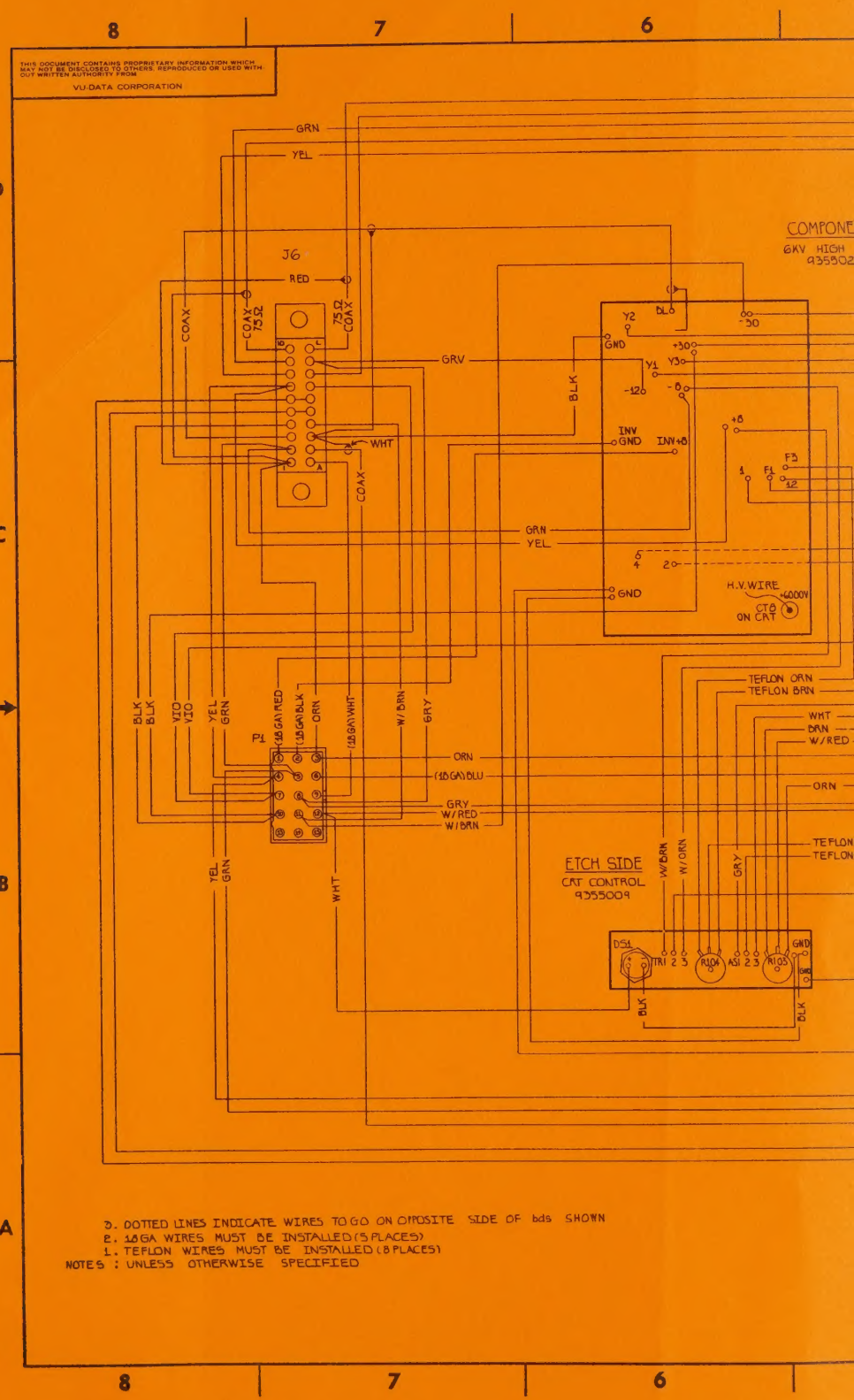

D. DOTTED LINES INDICATE WIRES TO GO ON OPPOSITE SIDE OF bds SHOWN
E. 18GA WIRES MUST BE INSTALLED (5 PLACES)
1. TEFLON WIRES MUST BE INSTALLED (8 PLACES)

NOTES : UNLESS OTHERWISE SPECIFIED

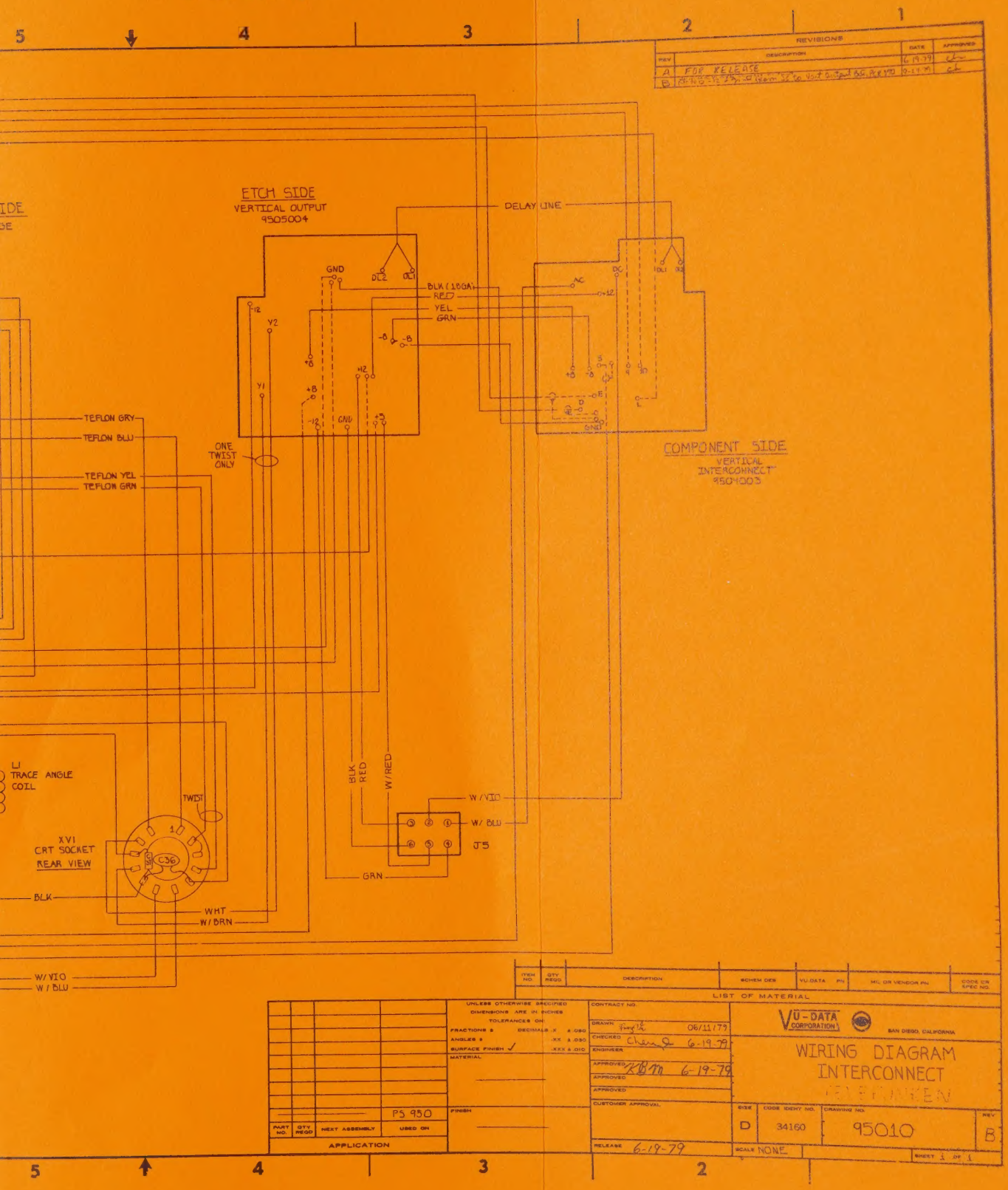

Figure 7-11. Interconnect Wiring Diagram-Telefunken 9501010